



Software Compliance Approach
1992, 1993, and 1995 Model Energy Code
Version 2.07

June 1998

MECcheckTM was developed by the Building Energy Standards Program at Pacific Northwest National Laboratory for use by the U.S. Department of Housing and Urban Development (HUD) and the Rural Economic and Community Development (RECD) under contract with the U.S. Department of Energy's Office of Codes and Standards. Pacific Northwest National Laboratory is operated by Battelle Memorial Institute for the U.S. Department of Energy under Contract DE-AC06-76RLO 1830.

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MECcheck Materials Overview

June 1998

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What is the Model Energy Code?

The Model Energy Code (MEC)^(a) contains energy-related building requirements applying to many new U.S. residences. The U.S. Department of Housing and Urban Development (HUD) loan guarantee program requires compliance with the MEC. The Rural Economic and Community Development (RECD, formerly the Farmer's Home Administration) loan guarantee program requires that single-family buildings comply with the MEC. Several states have also adopted the MEC as their residential energy code.

A major focus of the MEC provisions is on the building envelope insulation and window requirements,^(b) which are more stringent in colder climates. Other requirements focus on the heating and cooling system (including ducts), water heating system, and air leakage.

What Buildings Must Comply?

The MEC applies to new residential buildings, three stories or less in height, and additions to such buildings. Residential buildings are defined as detached one- and

(a) The MEC is maintained by the Council of American Building Officials (CABO). CABO is an "umbrella" organization consisting of three U.S. model code groups: the Building Officials and Code Administrators International, Inc. (BOCA), the International Conference of Building Officials (ICBO), and the Southern Building Code Congress International, Inc. (SBCCI).

(b) The building envelope consists of all building components that enclose heated and/or cooled spaces. The phrase "insulation and window requirements" is used throughout this workbook to represent the building envelope thermal requirements, as opposed to requirements relating to the heating and cooling system, water heating system, and air leakage.

two-family buildings (referred to as single-family buildings) and multifamily buildings (such as apartments, condominiums, townhouses, and rowhouses). Multifamily buildings have three or more attached dwelling units (see Appendix A for definitions of single-family and multifamily buildings and dwelling unit). Throughout this workbook, generic references to "building(s)" signify residential buildings three stories or less in height.

Exemptions: The following building categories are exempted from the provisions of the MEC:

- existing buildings
- very low-energy buildings ($<3.4 \text{ Btu/h}\cdot\text{ft}^2$ or 1 W/ft^2)
- buildings (or portions of buildings) that are neither heated nor cooled
- buildings designated as historical.

About the MECcheck Materials

The MECcheck materials are applicable to the 1992, 1993, and 1995 MEC and refer to these codes collectively as the MEC. Although these codes are quite similar, there are some differences in the code requirements that occasionally must be reflected in the text of the materials. When a block of text or a table only applies to a certain edition of the MEC, the applicable year is printed in the margin to the left of the text or table:

1992
1993
1995

indicates text is only applicable to the indicated MEC edition.

The MECcheck materials provide guidance on how to meet the MEC requirements. Making the MEC simple and understandable was the major motivation for developing them. The desire for simplicity and clarity led to changes in format, deletion of redundant text, and deletion of text that had no impact. If you are familiar with the MEC, you will note that these materials differ significantly in format from the MEC.

The MECcheck materials were created for HUD and RECD. Check with your building department or other state or local building code enforcement authority to verify that the MECcheck materials are accepted in your jurisdiction, because some of the requirements may be superseded by state laws or local ordinances.

It is not necessary to have a copy of the MEC to use any MECcheck materials. Although the *Basic Requirements Guide* lists MEC section numbers for cross reference, it is not necessary to refer to the referenced sections. All references to figures and tables in a specific guide refer to figures and tables located in that guide unless specifically stated otherwise.

What's in the MECcheck Guides?

The *Basic Requirement Guide* applies to all residential buildings and should be read by all users of MECcheck materials. Home builders and designers can then use one of the three MECcheck approaches to show compliance with the insulation and window requirements. The prescriptive package approach is described in the *Prescriptive Package User's Guide*. The software approach is described in the *Software User's Guide*. The trade-off approach is described in the *Trade-Off Worksheet User's Guide*. The *MECcheck Workbook* is a collection of guides which includes the *Basic Requirements Guide*, the *Prescriptive Packages User's Guide*, and the *Software User's Guide*, with the software diskette attached to the last page.

The *Basic Requirements Guide* discusses all of the basic requirements except for the insulation and window requirements (which are covered in other guides). The basic requirements represent minimum criteria that must be met regardless of which insulation compliance approach you choose. These criteria include provisions that limit air leakage through the building envelope and regulate heating and cooling systems and duct insulation levels.

The *Prescriptive Package User's Guide* describes the simplest of the three compliance approaches. With this approach, you select a package of insulation and window requirements from a list of packages developed for a specific climate zone. Each package specifies insulation levels, glazing areas, glazing U-values,^(a) and sometimes heating and cooling equipment efficiency. Once selected, simply meet or exceed all requirements listed in the package to achieve compliance. Few calculations are required.

The *Trade-Off Approach Worksheet User's Guide* briefly describes a "pencil-and-paper" compliance approach. The trade-off approach enables you to trade off insulation and window efficiency levels in different parts of the building. You can trade off ceiling, wall, floor, basement wall, slab-edge, and crawl space wall insulation; glazing and door areas; and glazing and door U-values. The trade-off approach calculates whether your home as a whole meets the overall MEC insulation and window requirements.

The *Software User's Guide* explains how to use the MECcheck software approach. The software approach is the most flexible of the three compliance approaches. The MECcheck software is designed for computers running Windows 3.1, Windows 95, and Windows NT. DOS-based versions are available on request (see the inside front cover for our hotline number and web address). The software allows trade-offs between all building envelope components and heating and cooling equipment efficiencies. With minimal input, you can quickly compare different insulation levels to select a package that works best for your proposed building. Unlike the

(a) U-values are a measure of how well a material or series of materials conduct heat (higher U-values indicate more heat loss). For door and window assemblies, the U-value is the reciprocal of the R-value ($U\text{-value}=1/R\text{-value}$).

prescriptive package and trade-off approaches, the software approach enables you to trade off basement wall, slab-edge, and crawl space wall insulation depth as well as insulation R-value. The software automatically generates a report that can be submitted to enforcement personnel to document compliance.

Several forms, worksheets, and lists are included with the MECcheck materials to help determine and document compliance. You may make multiple copies of the forms and distribute them freely. Alternative forms that provide the same information may also be used if they are approved by your jurisdiction.

Who Should Use the MECcheck Materials?

The MECcheck materials were designed to guide builders and designers, plan check personnel, and field inspectors through the MEC compliance process. All necessary compliance forms, reference materials, and explanations are included.

Builders and Designers can follow each step of the compliance process presented in the MECcheck guides. The *Basic Requirement Guide* describes MEC requirements that must be satisfied by all residences. The *Prescriptive Package User's Guide*, the *Software User's Guide*, and the *Trade-Off Worksheet User's Guide* offers a choice of approaches, any of which can be used to show compliance with the insulation and window requirements of the MEC.

Plan Check Personnel can use the *Plan Check and Field Inspection Guide* as a guide to ensure that building plans and specifications comply with the MEC. If questions arise, the plan reviewer can trace the compliance steps used by the applicant and reference the steps in the other guides.

Field Inspectors and Site Superintendents can use the *Plan Check and Field Inspection Guide* to ensure that all of the applicable MEC requirements have been installed in a building. The features that meet these requirements should be included on the building plans or specifications and on compliance forms. The *Basic Requirements Guide* will also be of interest to field inspectors and site superintendents. It describes the features that must be installed in the building regardless of the compliance approach chosen.

MECcheck Compliance Process?

Figure 1 illustrates the steps you should follow to determine compliance with the MEC.

Step 1: **Determine If Your Building Must Comply With the MEC.** (See *What Buildings Must Comply?* in this guide.)

Step 2: **Meet the Basic Requirements.** The basic requirements discussed in the *Basic Requirements Guide* must be incorporated into the design.

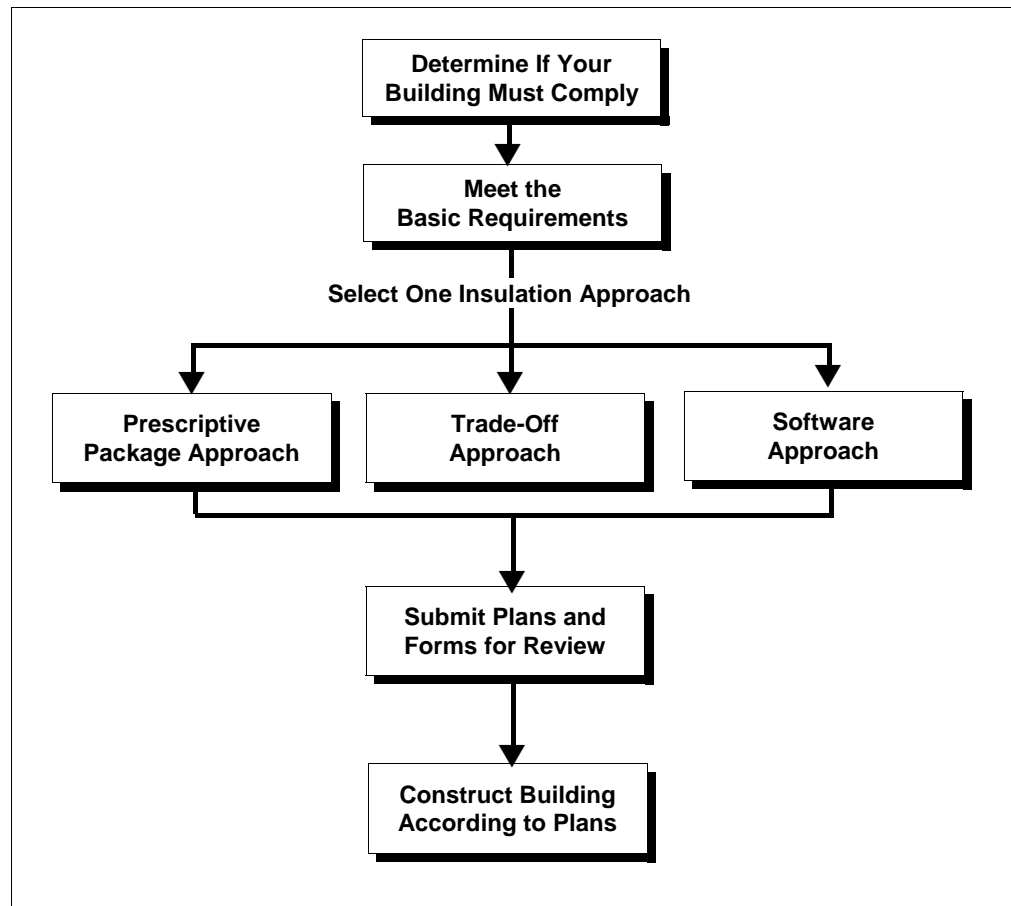


Figure 1. MECcheck Compliance Path

Step 3: Use One of Three Compliance Approaches for Insulation and Windows.

Select one of the three compliance approaches described in the *Prescriptive Packages User's Guide*, the *Software User's Guide*, and the *Trade-Off Worksheet User's Guide*. Examining the prescriptive packages for the building location will give an idea of the insulation requirements. Use the selected approach to determine the insulation and window requirements. Document compliance on the form(s) provided for the selected approach.

Step 4: Submit Building Plans and Compliance Forms for Plan Review.

Submit MECcheck forms or their equivalent, building plans, and specifications for plan review. The compliance forms must match the building plans and specifications.

Step 5: Construct the Building According to Approved Plans. In most jurisdictions, construction may begin after a building permit is issued. It is important to have the approved set of plans and specifications at the job site for use by the field inspector. MECcheck forms or their equivalent must be re-submitted if changes from the approved plans or specifications are made that increase the glazing area, decrease insulation R-values, or decrease equipment efficiencies of the building.

Basic Requirements Guide

June 1998

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Summary of Basic Requirements	

Introduction

The MEC specifies basic requirements that are mandatory for all buildings. Some of these requirements apply to the heating and cooling system (including ducts), hot water system, and electrical system. Other requirements apply to material and equipment identification and to sealing the building envelope. This guide discusses the MEC basic requirements, except for the insulation and window requirements (which are covered in other guides). Each requirement in this guide lists the corresponding MEC section number as a reference.

Figure 1 graphically illustrates several basic requirements. Refer to the *Summary of Basic Requirements* provided with this guide for a one-page listing of the requirements discussed here.

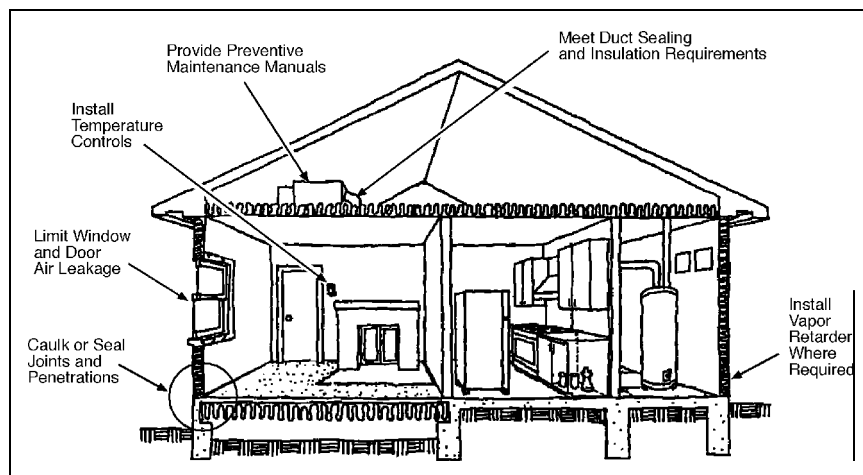


Figure 1. Some of the Basic Requirements

Building Envelope

Air Leakage

1992 (Section 502.4.3)

1993 (Section 502.3.3)

1995 (Section 502.3.3 and 502.3.4)

All joints and penetrations in the building envelope that are sources of air leakage must be caulked, gasketed, weatherstripped, or otherwise sealed in an approved manner.

The following areas should be sealed:

- exterior joints around window and door frames
 - between wall sole plates, floors, and exterior wall panels
 - openings for plumbing, electricity, refrigerant, and gas lines in exterior walls, floors, and roofs
 - openings in the attic floor (such as where ceiling panels meet interior and exterior walls and masonry fireplaces)
 - service and access doors or hatches
 - all other similar openings in the building envelope
- 1995
- recessed lighting fixtures.

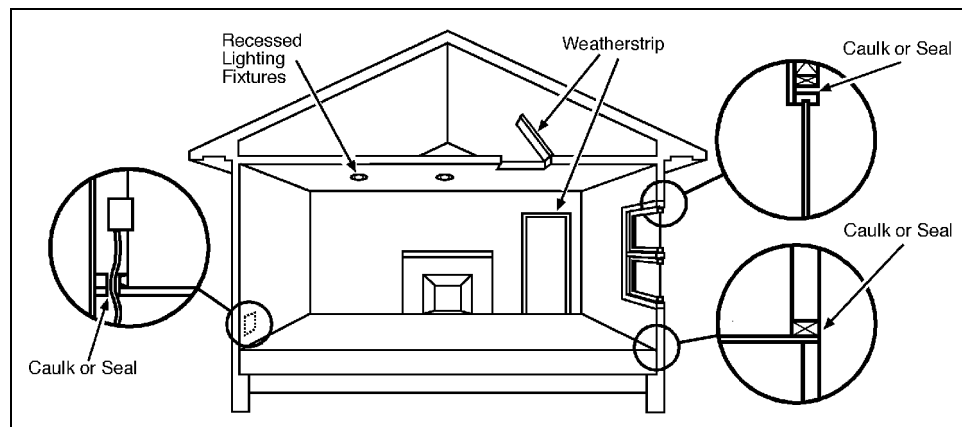


Figure 2 Typical Openings That Should Be Sealed

1992 (Section 502.4.2) The maximum leakage rate for manufactured windows is 0.34 cfm/ft of operable sash crack.

1993, 1995 (Section 502.3.2) The maximum air leakage rates for manufactured windows are given in Table 1.

Table 1. Maximum Leakage Rates for Manufactured Windows and Doors for 1993 and 1995 MEC

Frame Type	Windows (cfm/ft of Operable Sash Crack)	Doors (cfm per ft ² of Door Area)	
		Sliders	Swinging
Wood	0.34	0.35	0.5
Aluminum	0.37	0.37	0.5
PVC	0.37	0.37	0.5

Windows and doors certified by an accredited lab (such as the National Wood Window and Door Association [NWWDA] or the Architectural Aluminum Manufacturers Association [AAMA]) meet these requirements and will be labeled. For non-certified doors and windows, check manufacturer's test reports to verify compliance with these air leakage requirements.

Vapor Retarders

(Section 502.1.4) Vapor retarders must be installed in all non-vented framed ceilings, walls, and floors. Non-vented areas are framed cavities without vents or other openings allowing the free movement of air. The vapor retarder must have a perm rating of 1.0 or less and must be installed on the "warm-in-winter side" of the insulation (between the insulation and the conditioned space).

Exemptions: The above requirements do not apply to the following locations. For prescriptive package and trade-off worksheet approaches, your zone number can be found in Appendix E or on the state map included with the prescriptive packages. If you are using the MECcheck™ software, the vapor retarder requirement is printed in the software compliance report. If the requirement is not printed in the report, the building's location is exempt from the requirement.

- Texas Zones 2-5
- Alabama, Georgia, N. Carolina, Oklahoma, S. Carolina Zones 4-6
- Arkansas, Tennessee Zones 6-7
- Florida, Hawaii, Louisiana, Mississippi All Zones

Vapor retarders are not required where moisture or its freezing will not damage the materials.

Materials and Equipment Information

(Section 104.2) Insulation R-values and glazing and door U-values must be clearly marked on the building plans or specifications. If two or more different insulation levels exist for the same component, record each level separately on the plans or specifications. For example, if the walls adjacent to the garage have less insulation than the other walls, both insulation levels must be noted. If credit is taken for high-efficiency heating or cooling equipment, the equipment efficiency, make and model number must also be marked on the plans or specifications.

(Section 102.1) Materials and equipment must be identified so that compliance with the MEC can be determined. There are several ways to label materials and equipment to satisfy this requirement.

- Provide labels on all pertinent materials and equipment. For example, the R-value of the insulation is often pre-printed directly on the insulation or can be determined from a striping code. Window U-values are often included on the manufacturer label posted directly on the window.
- Provide contractor statements certifying the products they have installed. For example, the insulation contractor should certify the R-value of the installed insulation.
- An optional *Energy Label* is included in Appendix D. Materials and equipment can be identified on this label which should then be posted in the residence (e.g., on the main fuse box, on a garage wall, in the utility room) to document the energy efficiency features of the building.

1995

For blown or sprayed insulation, the initial installed thickness, the settled thickness, the coverage area, and the number of bags must be clearly posted at the job site. In attics, thickness markers must be placed at least once every 300 ft².

Check with your local building official to determine what is required in your jurisdiction.

(Section 102.2) Manufacturer manuals for all installed heating and cooling equipment and service water heating equipment must be provided.

Heating and Cooling

Heating and Cooling Equipment Efficiencies

The MEC defines heating and cooling equipment efficiency requirements. However, federal regulations have restricted manufactured equipment efficiency minimums to levels above these MEC requirements. Because new equipment with efficiencies

below the MEC requirements can no longer be manufactured, these requirements have been omitted from the MECcheck materials.

Duct Insulation

1992, 1993 (Section 503.9.1)
1995 (Section 503.7.1)

Supply and return ductwork for heating and cooling systems located in unconditioned spaces (spaces neither heated nor cooled) must be insulated to the minimum R-value specified in Table 2. Select the zone number for your building location and find the R-value requirement from Table 2 based on where the ducts are located. For prescriptive package and trade-off worksheet approaches, your zone number can be found in Appendix E or on the state map included with the prescriptive packages. If you are using the MECcheck software, the duct insulation requirement is printed in the software compliance report.

When ducts are located in exterior building cavities, either

- the full insulation R-value requirement for that building component must be installed between the duct and the building exterior, in which case the ducts do not require insulation, or
- the ducts must be insulated to the duct R-value requirement given in Table 2 and the duct area must be treated as a separate component. For example, if ducts insulated to R-6 are located in an exterior wall insulated to R-19, the area of the wall minus the duct area is a wall component with R-19 insulation, and the area of the ducts is a wall component with R-6 insulation.

1992 Table 2. Duct Insulation R-Value Requirements for 1992 MEC

Zone Number	Ducts in Unconditioned Spaces (i.e. Attics, Crawl Spaces, Unheated Basements and Garages, and Exterior Cavities)	Ducts Outside the Building
Zones 1-8	R-6	R-6
Zones 9-16	R-8	R-6
Zone 17	R-9	R-6
Zone 18	R-9	R-8
Zone 19	R-11	R-8

1993, 1995 Table 2. Duct Insulation R-Value Requirements for 1993 and 1995 MEC

Zone Number	Ducts in Unconditioned Spaces (i.e. Attics, Crawl Spaces, Unheated Basements and Garages, and Exterior Cavities)	Ducts Outside the Building
Zones 1-4	R-5	R-8
Zones 5-14	R-5	R-6.5
Zone 15-19	R-5	R-8

Exceptions: Duct insulation is not required in the following cases:

- within heating, ventilating, and air conditioning (HVAC) equipment
- for exhaust air ducts
- when the design temperature difference between the air in the duct and the surrounding air is 15°F or less.

Additional insulation with vapor barrier must be provided if condensation will create a problem.

Duct Construction

1992, 1993 (Section 503.10.2) All transverse joints in ductwork located in unconditioned spaces must be sealed with mastic, tape, or mastic plus tape. Pressure-sensitive tape may be used for fiberglass ductwork.

1995 (Section 503.8.2) Ducts must be sealed using mastic with fibrous backing tape. For fibrous ducts, pressure-sensitive tape may be used. Other sealants may be approved by the building official. Duct tape is not permitted.

1992, 1993 (Section 503.6)
1995 (Section 503.5)
The HVAC system must provide a means for balancing air and water systems. For air systems, this requirement can be met by installing manual dampers at each branch of the ductwork or by installing adjustable registers that can constrict the airflow into a room. For water systems, balancing valves can be installed to control the water flow to rooms or zones.

Temperature Controls

- 1992, 1993 (Section 503.8.3.1)
1995 (Section 503.6.3.1)
For one- and two-family buildings, at least one thermostat must be provided for each separate system (heating, cooling, or combination heating and cooling). Electric baseboard heaters can be individually controlled by separate thermostats or several baseboard heaters can be controlled by a single thermostat.
- 1992, 1993 (Section 503.8.3.2)
1995 (Section 503.6.3.2)
For multifamily buildings, each dwelling unit must have a separate thermostat and a readily accessible, manual or automatic means to restrict or shut off the heating and/or cooling input to each room must be provided. Operable diffusers or registers that can restrict or shut off the airflow into a room meet this requirement.
- 1992, 1993 (Section 503.8.3.3)
1995 (Section 503.6.3.2)
At least one thermostat must be provided for each system or each zone in the non-dwelling portions of multifamily buildings. For example, separate systems serving interior corridors or attached laundry rooms must have their own thermostat.
- 1992, 1993 (Section 503.8)
1995 (Section 503.6.1)
Each heating and cooling system must have a thermostat with at least the following range:
- heating only 55°F to 75°F
 - cooling only 70°F to 85°F
 - heating and cooling 55°F to 85°F
- The thermostat must be capable of operating the system heating and cooling in sequence (i.e., simultaneous operation is not permitted).

Heat Pump Thermostats

- 1992, 1993 (Section 503.4.2.3)
1995 (Section 503.3.2.2)
Heat pump installations must include a thermostat that can prevent the back-up heat from turning on when the heating requirements can be met by the heat pump alone. A two-stage thermostat that controls the back-up heat on its second stage meets this requirement.

HVAC Piping Insulation

1992, 1993 (Section 503.11)

1995 (Sections 503.9)

All HVAC piping (such as in hydronic heating systems) installed in unconditioned spaces and conveying fluids at temperatures greater than 120°F or chilled fluids at less than 55°F must be insulated to the thicknesses specified in Table 3. Pipe insulation is not required for piping installed within HVAC equipment.

Table 3. Minimum HVAC Piping Insulation Thickness^(a)

Piping System Types	Fluid Temp Range (°F)	Insulation Thickness in Inches by Pipe Sizes ^(b)			
		Runouts 2 in. ^(c)	1 in. and Less	1.25 in. to 2 in.	2.5 in. to 4 in.
Heating Systems					
Low Pressure/Temperature	201-250	1.0	1.5	1.5	2.0
Low Temperature	120-200	0.5	1.0	1.0	1.5
Steam Condensate (for feed water)	Any	1.0	1.0	1.5	2.0
Cooling Systems					
Chilled Water, Refrigerant, or Brine	40-55	0.5	0.5	0.75	1.0
	Below 40	1.0	1.0	1.5	1.5

(a) The pipe insulation thicknesses specified in this table are based on insulation R-values ranging from R-4 to R-4.6 per inch of thickness. For materials with an R-value greater than R-4.6, the insulation thickness specified in this table may be reduced as follows:

$$\text{New Minimum Thickness} = \frac{4.6 \times \text{Table 2-3 Thickness}}{\text{Actual R-Value}}$$

For materials with an R-value less than R-4, the minimum insulation thickness must be increased as follows:

$$\text{New Minimum Thickness} = \frac{4.0 \times \text{Table 2-3 Thickness}}{\text{Actual R-Value}}$$

(b) For piping exposed to outdoor air, increase thickness by 0.5 in.

(c) Applies to runouts not exceeding 12 ft in length to individual terminal units.

Service (Potable) Water Heating

Swimming Pools

(Section 504.5) All heated swimming pools must be equipped with an on/off pool heater switch mounted for easy access. Heated pools require a pool cover unless over 20% of the heating energy is from non-depletable sources (such as solar heat).

(Section 504.5.3) All swimming pool pumps must be equipped with a time clock.

Circulating Service Hot Water Systems

(Section 504.6) Circulating hot water systems must have automatic or manual controls that allow the pumps to be conveniently turned off when the hot water system is not in operation.

(Section 504.7) Piping in circulating hot water systems must be insulated to the levels specified in Table 4 unless an engineering calculation is provided that demonstrates that insulation will not reduce the annual energy requirements of the building.

Table 4. Minimum Insulation Thickness for Recirculation Piping

Heated Water Temperature (°F)	Insulation Thickness in Inches by Pipe Sizes ^(a)			
	Non-Circulating Runouts	Circulating Mains and Runouts		
	Up to 1 in.	Up to 1.25 in.	1.5 - 2.0 in.	Over 2 in.
170-180	0.5	1.0	1.5	2.0
140-160	0.5	0.5	1.0	1.5
100-130	0.5	0.5	0.5	1.0
(a) Nominal pipe size and insulation thickness.				

Electrical

1992, 1993
1995

(Section 505.2)

(Section 505.1)

All dwelling units in multifamily buildings must be equipped with separate electric meters.

1992 Model Energy Code
Summary of Basic Requirements

Air Leakage	<p>Joints, penetrations, and all other such openings in the building envelope that are sources of air leakage must be caulked, gasketed, weatherstripped, or otherwise sealed.</p> <p>The maximum leakage rate for manufactured windows is 0.34 cfm/ft of operable sash crack. The maximum leakage rate for manufactured doors is .5 cfm/ft² of door area.</p>						
Vapor Retarder	<p>Vapor retarders must be installed on the warm-in-winter side of all non-vented framed ceilings, walls, and floors. This requirement does not apply to the following climate zones nor where moisture or its freezing will not damage the materials.</p> <ul style="list-style-type: none"> • Texas Zones 2-5 • Alabama, Georgia, N. Carolina, Oklahoma, S. Carolina Zones 4-6 • Arkansas, Tennessee Zones 6-7 • Florida, Hawaii, Louisiana, Mississippi All Zones 						
Materials and Insulation Information	<p>Materials and equipment must be identified so that compliance can be determined. Manufacturer manuals for all installed heating and cooling equipment and service water heating equipment must be provided. Insulation R-values, glazing and door U-values, and heating and cooling equipment efficiency (if high-efficiency credit is taken) must be clearly marked on the building plans or specifications.</p>						
Duct Insulation	<p>Supply and return ducts for heating and cooling systems located in unconditioned spaces must be insulated to the levels shown on the reverse side of this sheet.</p> <p>Exceptions: Insulation is not required for exhaust air ducts, ducts within HVAC equipment, and when the design temperature difference between the air in the duct and the surrounding air is 15°F or less.</p>						
Duct Construction	<p>All transverse joints must be sealed with mastic, tape, or mastic plus tape. The HVAC system must provide a means for balancing air and water systems.</p>						
Temperature Controls	<p>Thermostats are required for each separate HVAC system in single-family buildings and each dwelling unit in multifamily buildings (non-dwelling portions of multifamily buildings must have one thermostat for each system or zone). Thermostats must have the following ranges:</p> <table style="margin-left: 40px;"> <tr> <td>Heating Only</td><td>55°F - 75°F</td></tr> <tr> <td>Cooling Only</td><td>70°F - 85°F</td></tr> <tr> <td>Heating and Cooling</td><td>55°F - 85°F</td></tr> </table> <p>A manual or automatic means to partially restrict or shut off the heating and/or cooling input to each zone or floor shall be provided for single-family homes and to each room for multifamily buildings.</p>	Heating Only	55°F - 75°F	Cooling Only	70°F - 85°F	Heating and Cooling	55°F - 85°F
Heating Only	55°F - 75°F						
Cooling Only	70°F - 85°F						
Heating and Cooling	55°F - 85°F						
HVAC Piping Insulation	<p>HVAC piping in unconditioned spaces conveying fluids at temperatures above 120°F or chilled fluids at less than 55°F must be insulated to the levels shown on the reverse side of this sheet.</p>						
Swimming Pools	<p>All heated swimming pools must have an on/off pool heater switch. Heated pools require a pool cover unless over 20% of the heating energy is from non-depletable sources. All swimming pool pumps must be equipped with a time clock.</p>						
Circulating Hot Water	<p>Circulating hot water systems must have automatic or manual controls and pipes must be insulated to the levels shown on the reverse side of this sheet.</p>						
Electric Systems	<p>Each multifamily dwelling unit must be equipped with separate electric meters.</p>						

1992 Model Energy Code

Duct Insulation R-Value Requirements

Zone Number	Duct Insulation R-Value Requirements	
	Ducts Located In: Attics, Crawl Spaces, Exterior Cavities, Outside	Ducts Located In: Unheated Basements
Zones 1-8	R-6	R-6
Zones 9-16	R-8	R-6
Zone 17	R-9	R-6
Zone 18	R-9	R-8
Zone 19	R-11	R-8

Minimum Insulation Thickness for HVAC Pipes^(a)

Piping System Types	Fluid Temp Range (°F)	Insulation Thickness in Inches by Pipe Sizes ^(b)			
		Runouts 2 in. ^(c)	1 in. and Less	1.25 in. to 2 in.	2.5 in. to 4 in.
Heating Systems					
Low Pressure/Temperature	201-250	1.0	1.5	1.5	2.0
Low Temperature	120-200	0.5	1.0	1.0	1.5
Steam Condensate (for feed water)	Any	1.0	1.0	1.5	2.0
Cooling Systems					
Chilled Water, Refrigerant, or Brine	40-55	0.5	0.5	0.75	1.0
	Below 40	1.0	1.0	1.5	1.5

(a) The pipe insulation thicknesses specified in this table are based on insulation R-values ranging from R-4 to R-4.6 per inch of thickness. For materials with an R-value greater than R-4.6, the insulation thickness specified in this table may be reduced as follows:

$$New\ Minimum\ Thickness = \frac{4.6 \times Table\ 2-2\ Thickness}{Actual\ R-Value}$$

For materials with an R-value less than R-4, the minimum insulation thickness must be increased as follows:

$$New\ Minimum\ Thickness = \frac{4.0 \times Table\ 2-2\ Thickness}{Actual\ R-Value}$$

(b) For piping exposed to outdoor air, increase thickness by 0.5 in.

(c) Applies to runouts not exceeding 12 ft in length to individual terminal units.

Minimum Insulation Thickness for Circulating Hot Water Pipes

Heated Water Temperature (°F)	Insulation Thickness in Inches by Pipe Sizes ^(a)			
	Non-Circulating Runouts	Circulating Mains and Runouts		
	Up to 1 in.	Up to 1.25 in.	1.5 - 2.0 in.	Over 2 in.
170-180	0.5	1.0	1.5	2.0
140-160	0.5	0.5	1.0	1.5
100-130	0.5	0.5	0.5	1.0
(a) Nominal pipe size and insulation thickness.				

1993 Model Energy Code
Summary of Basic Requirements

Air Leakage	Joints, penetrations, and all other such openings in the building envelope that are sources of air leakage must be caulked, gasketed, weatherstripped, or otherwise sealed. The maximum leakage rates for manufactured windows and doors are shown on the reverse side.						
Vapor Retarder	<p>Vapor retarders must be installed on the warm-in-winter side of all non-vented framed ceilings, walls, and floors. This requirement does not apply to the following climate zones nor where moisture or its freezing will not damage the materials.</p> <ul style="list-style-type: none"> • Texas Zones 2-5 • Alabama, Georgia, N. Carolina, Oklahoma, S. Carolina Zones 4-6 • Arkansas, Tennessee Zones 6-7 • Florida, Hawaii, Louisiana, Mississippi All Zones 						
Materials and Insulation Information	Materials and equipment must be identified so that compliance can be determined. Manufacturer manuals for all installed heating and cooling equipment and service water heating equipment must be provided. Insulation R-values, glazing and door U-values, and heating and cooling equipment efficiency (if high-efficiency credit is taken) must be clearly marked on the building plans or specifications.						
Duct Insulation	<p>Supply and return ducts for heating and cooling systems located in unconditioned spaces must be insulated to the levels shown on the reverse side of this sheet.</p> <p>Exceptions: Insulation is not required for exhaust air ducts, ducts within HVAC equipment, and when the design temperature difference between the air in the duct and the surrounding air is 15°F or less.</p>						
Duct Construction	All transverse joints must be sealed with mastic, tape, or mastic plus tape. The HVAC system must provide a means for balancing air and water systems.						
Temperature Controls	<p>Thermostats are required for each separate HVAC system in single-family buildings and each dwelling unit in multifamily buildings (non-dwelling portions of multifamily buildings must have one thermostat for each system or zone). Thermostats must have the following ranges:</p> <table style="margin-left: 40px;"> <tr> <td>Heating Only</td> <td>55°F - 75°F</td> </tr> <tr> <td>Cooling Only</td> <td>70°F - 85°F</td> </tr> <tr> <td>Heating and Cooling</td> <td>55°F - 85°F</td> </tr> </table> <p>A manual or automatic means to partially restrict or shut off the heating and/or cooling input to each zone or floor shall be provided for single-family homes and to each room for multifamily buildings.</p>	Heating Only	55°F - 75°F	Cooling Only	70°F - 85°F	Heating and Cooling	55°F - 85°F
Heating Only	55°F - 75°F						
Cooling Only	70°F - 85°F						
Heating and Cooling	55°F - 85°F						
HVAC Piping Insulation	HVAC piping in unconditioned spaces conveying fluids at temperatures above 120°F or chilled fluids at less than 55°F must be insulated to the levels shown on the reverse side of this sheet.						
Swimming Pools	All heated swimming pools must have an on/off pool heater switch. Heated pools require a pool cover unless over 20% of the heating energy is from non-depletable sources. All swimming pool pumps must be equipped with a time clock.						
Circulating Hot Water	Circulating hot water systems must have automatic or manual controls and pipes must be insulated to the levels shown on the reverse side of this sheet.						
Electric Systems	Each multifamily dwelling unit must be equipped with separate electric meters.						

1993 Model Energy Code

Duct Insulation R-Value Requirements

Zone Number	Ducts in Unconditioned Spaces (i.e. Attics, Crawl Spaces, Unheated Basements and Garages, and Exterior Cavities)	Ducts Outside the Building
Zones 1-4	R-5	R-8
Zones 5-14	R-5	R-6.5
Zone 15-19	R-5	R-8

Maximum Leakage Rates for Manufactured Windows and Doors

Frame Type	Windows (cfm/ft of Operable Sash Crack)	Doors (cfm per ft ² of Door Area)	
		Sliders	Swinging
Wood	0.34	0.35	0.5
Aluminum	0.37	0.37	0.5
PVC	0.37	0.37	0.5

Minimum Insulation Thickness for HVAC Pipes^(a)

Piping System Types	Fluid Temp Range (°F)	Insulation Thickness in Inches by Pipe Sizes ^(b)			
		Runouts 2 in. ^(c)	1 in. and Less	1.25 in. to 2 in.	2.5 in. to 4 in.
Heating Systems					
Low Pressure/Temperature	201-250	1.0	1.5	1.5	2.0
Low Temperature	120-200	0.5	1.0	1.0	1.5
Steam Condensate (for feed water)	Any	1.0	1.0	1.5	2.0
Cooling Systems					
Chilled Water, Refrigerant, or Brine	40-55	0.5	0.5	0.75	1.0
	Below 40	1.0	1.0	1.5	1.5
<p>(a) The pipe insulation thicknesses specified in this table are based on insulation R-values ranging from R-4 to R-4.6 per inch of thickness. For materials with an R-value greater than R-4.6, the insulation thickness specified in this table may be reduced as follows:</p> $\text{New Minimum Thickness} = \frac{4.6 \times \text{Table 2-2 Thickness}}{\text{Actual R-Value}}$ <p>For materials with an R-value less than R-4, the minimum insulation thickness must be increased as follows:</p> $\text{New Minimum Thickness} = \frac{4.0 \times \text{Table 2-2 Thickness}}{\text{Actual R-Value}}$ <p>(b) For piping exposed to outdoor air, increase thickness by 0.5 in.</p> <p>(c) Applies to runouts not exceeding 12 ft in length to individual terminal units.</p>					

Minimum Insulation Thickness for Circulating Hot Water Pipes

Heated Water Temperature (°F)	Insulation Thickness in Inches by Pipe Sizes ^(a)			
	Non-Circulating Runouts	Circulating Mains and Runouts		
	Up to 1 in.	Up to 1.25 in.	1.5 - 2.0 in.	Over 2 in.
170-180	0.5	1.0	1.5	2.0
140-160	0.5	0.5	1.0	1.5
100-130	0.5	0.5	0.5	1.0
(a) Nominal pipe size and insulation thickness.				

1995 Model Energy Code
Summary of Basic Requirements

Air Leakage	Joints, penetrations, and all other such openings in the building envelope that are sources of air leakage must be caulked, gasketed, weatherstripped, or otherwise sealed. The maximum leakage rates for manufactured windows and doors are shown on the reverse side. Recessed lights must be type IC rated and installed with no penetrations or installed inside an appropriate air-tight assembly with a 0.5-in. Clearance from combustible materials and 3-in. Clearance from insulation.						
Vapor Retarder	<p>Vapor retarders must be installed on the warm-in-winter side of all non-vented framed ceilings, walls, and floors. This requirement does not apply to the following climate zones nor where moisture or its freezing will not damage the materials.</p> <ul style="list-style-type: none"> • Texas Zones 2-5 • Alabama, Georgia, N. Carolina, Oklahoma, S. Carolina Zones 4-6 • Arkansas, Tennessee Zones 6-7 • Florida, Hawaii, Louisiana, Mississippi All Zones 						
Materials and Insulation Information	Materials and equipment must be identified so that compliance can be determined. Manufacturer manuals for all installed heating and cooling equipment and service water heating equipment must be provided. Insulation R-values, glazing and door U-values, and heating and cooling equipment efficiency (if high-efficiency credit is taken) must be clearly marked on the building plans or specifications.						
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Duct Construction	All transverse joints must be sealed with mastic, tape, or mastic plus tape. The HVAC system must provide a means for balancing air and water systems.						
Temperature Controls	<p>Thermostats are required for each separate HVAC system in single-family buildings and each dwelling unit in multifamily buildings (non-dwelling portions of multifamily buildings must have one thermostat for each system or zone). Thermostats must have the following ranges:</p> <table style="margin-left: 40px;"> <tr> <td>Heating Only</td><td>55°F - 75°F</td></tr> <tr> <td>Cooling Only</td><td>70°F - 85°F</td></tr> <tr> <td>Heating and Cooling</td><td>55°F - 85°F</td></tr> </table> <p>A manual or automatic means to partially restrict or shut off the heating and/or cooling input to each zone or floor shall be provided for single-family homes and to each room for multifamily buildings.</p>	Heating Only	55°F - 75°F	Cooling Only	70°F - 85°F	Heating and Cooling	55°F - 85°F
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Swimming Pools	All heated swimming pools must have an on/off pool heater switch. Heated pools require a pool cover unless over 20% of the heating energy is from non-depletable sources. All swimming pool pumps must be equipped with a time clock.						
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1995 Model Energy Code

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Minimum Insulation Thickness for HVAC Pipes^(a)

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Steam Condensate (for feed water)	Any	1.0	1.0	1.5	2.0
Cooling Systems					
Chilled Water, Refrigerant, or Brine	40-55	0.5	0.5	0.75	1.0
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<p>(a) The pipe insulation thicknesses specified in this table are based on insulation R-values ranging from R-4 to R-4.6 per inch of thickness. For materials with an R-value greater than R-4.6, the insulation thickness specified in this table may be reduced as follows:</p> $\text{New Minimum Thickness} = \frac{4.6 \times \text{Table 2-2 Thickness}}{\text{Actual R-Value}}$ <p>For materials with an R-value less than R-4, the minimum insulation thickness must be increased as follows:</p> $\text{New Minimum Thickness} = \frac{4.0 \times \text{Table 2-2 Thickness}}{\text{Actual R-Value}}$ <p>(b) For piping exposed to outdoor air, increase thickness by 0.5 in.</p> <p>(c) Applies to runouts not exceeding 12 ft in length to individual terminal units.</p>					

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Heated Water Temperature (°F)	Insulation Thickness in Inches by Pipe Sizes ^(a)			
	Non-Circulating Runouts	Circulating Mains and Runouts		
	Up to 1 in.	Up to 1.25 in.	1.5 - 2.0 in.	Over 2 in.
170-180	0.5	1.0	1.5	2.0
140-160	0.5	0.5	1.0	1.5
100-130	0.5	0.5	0.5	1.0
(a) Nominal pipe size and insulation thickness.				

Software User's Guide

June 1998

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Introduction

This user's guide describes how to use the MECcheck™ Software Version 2.07. MECcheck is designed to demonstrate compliance with the requirements of the Council of American Building Officials (CABO) Model Energy Code (MEC). It is the most flexible approach for meeting the MEC insulation and window requirements (refer to the Basic Requirements Guide for additional requirements that must also be satisfied). The MECcheck software runs on the Microsoft Windows operating system.

The MECcheck software demonstrates compliance with the 1992, 1993, and 1995 editions of the MEC. All illustrations in this chapter are based on compliance with the 1995 MEC. However, compliance with the other two editions is achieved similarly.

The software enables you to quickly compare different insulation levels in different parts of your building to arrive at a package that works best for you. A report that can be submitted with your building plans for plan review is automatically generated.

Model Energy Code Overview

The MEC specifies thermal envelope requirements for residential buildings three stories or less in height. Maximum U-value⁽¹⁾ requirements are specified for walls, ceilings, floors, crawl space walls, and basement walls and minimum R-value requirements are specified for slab floors. To comply with the MEC, a building must be constructed with components meeting or exceeding these requirements. However, the U-value of a given assembly may be increased or the R-value of a given assembly may be decreased, provided the total heat gain or loss for the entire building does not exceed the total resulting from conformance to the MEC requirements.

MECcheck performs a simple U-value x Area (UA) calculation for each building assembly to determine the overall UA of your building. The UA that would result from a building conforming to the MEC requirements is compared against the UA for your building. If the total heat loss (represented as a UA) through the envelope of your building does not exceed the total heat loss from the same building conforming to the MEC, then the software declares that you pass. A high-efficiency equipment trade-off can also be performed.

MECcheck is appropriate for insulation and window trade-off calculations in residential detached one- and two-family buildings (referred to as single-family buildings) and multifamily buildings (such as apartments, condominiums, townhouses, and rowhouses). Multifamily buildings include residential buildings three stories or less in height with three or more attached dwelling units. The MECcheck software generates a report that lists the insulation and window levels of your proposed building, as well as the additional basic requirements found in the MEC. The Basic Requirements Guide covers these other requirements in more detail.

What's in This Guide

Quick Start gives a short overview on how to install and run MECcheck. This chapter is designed to get you up and running in no time.

Getting Started discusses conventions used in this user's guide, lists the computer equipment required to run MECcheck, and provides further instructions on how to install and run MECcheck.

Required Information explains how to enter your building location and construction type.

Optional Information describes how to enter general information about your project.

Building Description explains how to describe your building and check for compliance with the MEC.

(1) U-values are a measure of how well a material or series of materials conduct heat (higher U-values indicate more heat loss). For door and window assemblies, the U-value is the reciprocal of the R-value ($U\text{-value}=1/R\text{-value}$).

Building Components describes the buttons at the top of the *Building Description* screen and how they are used to enter your building components.

HVAC Efficiency describes how to take credit for efficient heating and cooling equipment.

Menus provides an overview of the MECcheck menu options.

Compliance Example provides a step-by-step example of using the software approach to demonstrate compliance of a split-level house.

Files describes how to create, open, save, delete, and print files and reports.

Changing Location Files discusses how you can modify the location and weather data file used in the MECcheck.

Modifying the Cities or Counties gives instructions for changing from the cities version of MECcheck to the counties version, and vice versa.

Quick Start

Installing MECcheck

Insert the MECcheck floppy diskette into drive A: (or B:).

Run INSTALL.EXE from Windows (use the **Run...** option under the *File* menu or the *Start* menu).

Starting MECcheck

Click on the MECcheck icon located in the MECcheck Group (Windows 3.1) or under the *Start* menu (Windows 95).

Choosing Your Location

In the *Required Information* screen, you must enter the location of your building and indicate whether your building will be a single-family or multifamily building. MECcheck lists either the cities or counties for each state, depending on which version you are using. If you are using the cities version and your city is not in the list, choose the closest city with similar weather conditions.

Creating a Building Description

Use the buttons at the top of the *Building Description* screen to create a list of building components that describe the exterior envelope of your building. For each component selected, you must enter the component area or perimeter, cavity R-value, continuous R-Value, and/or U-value. Default R-values and U-values are supplied for you, but these should be changed to the values you intend to install in your building.

After you have entered all areas, R-values, and U-values, the program determines if your building design passes or fails. The results are displayed at the top of the screen in the *MEC Compliance* box. If *Invalid Area(s)* is displayed in this field, you have not filled in the area or perimeter for one or more components. The *% Better Than MEC* field gives a percentage which indicates the amount by which your house exceeds or fails code requirements.

Adding a High-Efficiency Equipment Trade-Off

The *Equipment* button on the tool bar can be used to display the *Heating and Cooling Efficiency* screen. Minimum Federal requirements for heating and cooling equipment efficiencies are displayed in the right-hand column. If you plan to install heating or cooling equipment that is more efficient than these minimums, you may take a high-efficiency equipment credit.

Saving Your Building Description and Creating a Report

Use the *File* menu to save your data (*File*→*Save*). Then, create or print a report based on that data (*File*→*Print Report* or *File*→*Save Report*).

Noteworthy...

- If you want to delete a component from your list of components, move to the first column of that component (the text description) and press the **Delete** key. Some components can be edited by moving to the first column and pressing the **Enter** key.
- The areas of all building components are entered in ft², with the exception of slab-on-grade components, which are entered as a perimeter in linear feet.
- You can add multiple copies of any component by selecting that component's button more than once.
- If you need help, refer to the message at the bottom of the main screen, or press **F1** for a help screen. An index of help topics is displayed by selecting the *Index* option from the *Help* menu or by selecting the *Show Index* button on any help screen.

Getting Started

Conventions Used in This Guide

The MECcheck software can be used to demonstrate compliance with the 1992, 1993, and 1995 editions of the MEC. Although these codes are quite similar, there are some differences in the code requirements that occasionally must be reflected in the text of this user's guide. When a block of text or a table only applies to a certain edition of the MEC, the applicable year is printed in the margin to the left of the text or table.

1992
1993
1995

Indicates text is only applicable to the indicated MEC edition.

ALL CAPITALS File and directory names are capitalized.

Bold Italics Commands are shown in bold italics.

Bold Initial Caps The keys on your keyboard, such as **Tab** and **Shift+Tab**, are shown in bold initial caps. Some keyboard short cuts require you to hold down the **Alt** key while pressing another key. For example, you press **Alt+F** to select the *File* menu. In this guide, short cuts are shown in bold type.

Italics An italic typeface is used to represent text as it appears on the screen in the program.

→ An arrow is used to indicate a sequence of menu and submenu selections, such as *Help→Index*.

What you Need to Run MECcheck

MECcheck for Windows requires a personal computer with the Intel 80386 (386) processor (or higher), 2 megabytes (MB) of extended memory, a hard disk with 2MB of free disk space, a VGA or Super VGA monitor, and Windows 3.1, Windows NT, or Windows 95. A Microsoft-compatible mouse is highly recommended but not required.

Installing MECcheck

To install MECcheck from the floppy diskette:

1. Put the diskette in your floppy disk drive (usually A or B);
2. Run the INSTALL.EXE program using the *Run* option under the *File* menu (Windows 3.1) or under the *Start* menu (Windows 95).

The installation screen will appear. Follow the instructions on the screen. You will be asked to choose the drive and subdirectory to which the MECcheck files will be copied. You may accept the default drive and subdirectory.

C:\MECCHECK

or you may type in the name of a different drive and/or subdirectory.

Starting MECcheck

Windows 3.1: The installation program will put the MECcheck icon in the MECcheck group. Double click on the icon.

Windows 95: The MECcheck program will be added to the *Start* menu. Click on the *Start* button and look for the MECcheck option under *Programs*.

Windows NT: MECcheck can be run as described above for Windows 3.1 or Windows 95, depending on the version of Windows NT. The MECcheck icon will be added to the MECcheck group.

Required Information

Your building's location and construction type (single family or multifamily) are entered in the *Required Information* screen. MECcheck lists either the cities or counties for each state, depending on which version you are using. The following illustration of the *Required Information* screen is from the cities version. The counties version is identical, except it lists counties for each state instead of cities. The location and construction type of your building are necessary for MECcheck to determine compliance. If this information is not accurate, the results will not be valid.

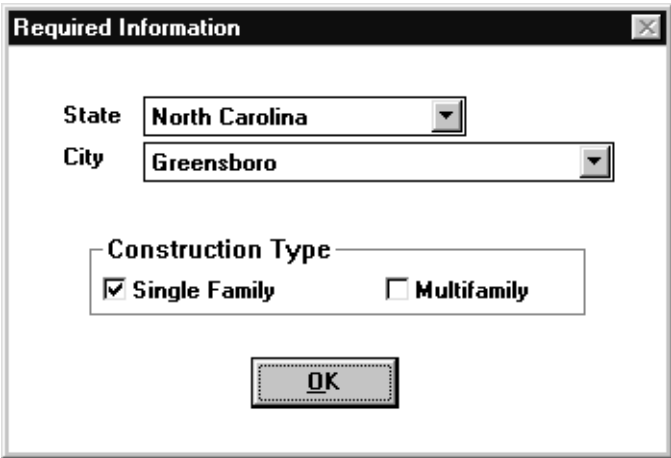
A screenshot of the "Required Information" dialog box. It has a title bar with the text "Required Information" and a close button. Inside the dialog, there are two dropdown menus: "State" with "North Carolina" selected, and "City" with "Greensboro" selected. Below these is a section titled "Construction Type" containing two radio buttons: "Single Family" (which is checked) and "Multifamily". At the bottom center is an "OK" button.

Figure 1. Required Information Screen

Whenever you exit MECcheck, the currently selected building location and construction type are saved. When re-entering the software, the location and construction type fields are automatically updated to reflect your last entries.

State

To choose a new state, move to the *State* field and press **Enter** or use the mouse to select the arrow button to the right of the field. A list appears containing state names. You can scroll through this list with the **Up** and **Down Arrow** keys, the **Page Up** and **Page Down** keys, or by using the mouse and scroll bar located to the right of the list. Press **Enter** or click on your desired state with the mouse.

City/County

Each time you enter a new state, the list of cities or counties changes -- reflecting only the cities or counties located in the new state. To choose a new location, move to the *City* or *County* field and press **Enter** or use the mouse to select the arrow button to the right of the field. A list appears containing the names of cities or counties located in the selected state. You can scroll through this list with the **Up** and **Down Arrow** keys, the **Page Up** and **Page Down** keys, or by using the mouse and scroll bar located to the right of the list. Press **Enter** or click on your desired location with the mouse. If you are using the cities version and you cannot find the city in which your building will be located, choose a city that is close to your building site and has similar weather conditions.

Construction Type

The MEC specifies different requirements for single-family and multifamily buildings, so MECcheck must know which of these construction types you are going to build. You must select either the single-family or the multifamily button.

Single Family

To choose single-family construction, press **Enter** or click on the *Single Family* button with the mouse. If the *Single Family* button is selected, an "X" appears in the square to the left of the text. Single-family buildings include all detached one- and two-family dwellings.

Multifamily

To choose multifamily construction, press **Enter** or click on the *Multifamily* button with the mouse. If the *Multifamily* button is selected, an "X" appears in the square to the left of the text. Multifamily buildings are three stories or less in height and contain three or more attached dwelling units. Apartments, condominiums, townhouses, and rowhouses are included in this category. Multifamily buildings can be considered as a whole or separate reports can be generated for each dwelling unit. Where individual units are identical, one report may be submitted as representative of the others. Contact the authority having jurisdiction to determine which approach to take.

Optional Information

The *Optional Information* screen is used to enter information about your project. All of the information entered in this screen is included in your project report. None of this information is required by the program to determine compliance with the MEC. This information may be useful, however, to the building department or as a way to track and label your reports.

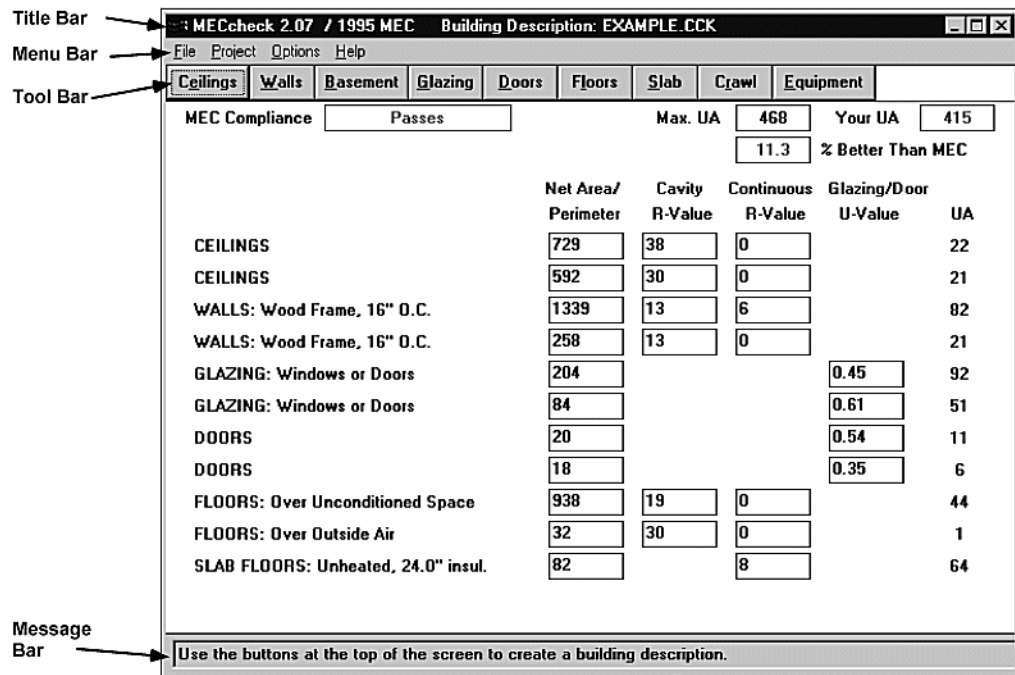


Figure 2. *Optional Information Screen*

- | | |
|----------------------|---|
| <i>Date of Plans</i> | The <i>Date of Plans</i> field is used to record the date stamped on the building plans. This date can be used to track the plans on which the MECcheck documentation is based, in the event that the plans are later modified. |
| <i>Title</i> | The <i>Title</i> field is a single-line text field used to enter a project title. You can use the title to identify specific projects. This title is displayed at the top of your report. |
| <i>Project</i> | Enter a description of your project in the <i>Project</i> field (such as the project name and address). You can use common text-editing keys to enter a description up to 500 characters in length. |
| <i>Company</i> | Enter a description of your company in the <i>Company</i> field (such as the name and address). You can use common text-editing keys to enter a description up to 500 characters in length. |
| <i>Notes</i> | Enter any additional information in the <i>Notes</i> field. You can use common text-editing keys to enter notes up to 500 characters in length. |

Building Description

The *Building Description* screen is the MECcheck main screen. The buttons located in the Tool Bar at the top of the screen are used to choose building components describing your home. Each component you choose is added to the building components list, which is displayed on the *Building Description* screen. The message at the bottom of the screen explains what type of information goes into the currently selected field.



MEC Compliance Max. UA Your UA
 % Better Than MEC

	Net Area/ Perimeter	Cavity R-Value	Continuous R-Value	Glazing/Door U-Value	UA
CEILINGS	<input type="text" value="729"/>	<input type="text" value="38"/>	<input type="text" value="0"/>		22
CEILINGS	<input type="text" value="592"/>	<input type="text" value="30"/>	<input type="text" value="0"/>		21
WALLS: Wood Frame, 16" O.C.	<input type="text" value="1339"/>	<input type="text" value="13"/>	<input type="text" value="6"/>		82
WALLS: Wood Frame, 16" O.C.	<input type="text" value="258"/>	<input type="text" value="13"/>	<input type="text" value="0"/>		21
GLAZING: Windows or Doors	<input type="text" value="204"/>			<input type="text" value="0.45"/>	92
GLAZING: Windows or Doors	<input type="text" value="84"/>			<input type="text" value="0.61"/>	51
DOORS	<input type="text" value="20"/>			<input type="text" value="0.54"/>	11
DOORS	<input type="text" value="18"/>			<input type="text" value="0.35"/>	6
FLOORS: Over Unconditioned Space	<input type="text" value="938"/>	<input type="text" value="19"/>	<input type="text" value="0"/>		44
FLOORS: Over Outside Air	<input type="text" value="32"/>	<input type="text" value="30"/>	<input type="text" value="0"/>		1
SLAB FLOORS: Unheated, 24.0" insul.	<input type="text" value="82"/>		<input type="text" value="8"/>		64

Message Bar: Use the buttons at the top of the screen to create a building description.

Figure 3. Building Description Screen

After you have filled in the information about each component, the program computes the UA of your proposed building and the UA of the code building. The code building has the same dimensions as your building but conforms to the MEC requirements. If the total UA of your building is less than or equal to the total UA of the code building, your building complies with the MEC and the *MEC Compliance* field displays the message "Passes."

Title Bar

The Title Bar on the *Building Description* screen displays the name of the currently open project data file. If no project data file is open, the Title Bar only displays the name of the screen -- *Building Description*.

Menu Bar

The Menu Bar is located directly under the Title Bar and displays the available menus. The Menu Bar contains four menus -- *File*, *Project*, *Options*, and *Help*.

Tool Bar The Tool Bar is a row of buttons located directly under the Menu Bar. The buttons on the Tool Bar are used to create a list of building components describing your building.

MEC Compliance The *MEC Compliance* field tells you whether your building complies with the MEC. One of the following messages is displayed:

Message	Meaning
<i>Invalid Area</i>	You have not entered the area and/or perimeter of one or more building components
<i>Passes</i>	Your building design complies with the MEC
<i>Fails</i>	Your building design DOES NOT comply with the MEC

Max. UA The *Max. UA* field displays the total UA of the code building (the house built to MEC requirements). To demonstrate compliance with the MEC, the UA of your house must be less than or equal to the UA displayed in this field.

Your UA The field labeled *Your UA* displays the UA of your proposed building based on the building components you chose from the Tool Bar and the information you supplied about each of these components. The UA displayed in this field must be less than or equal to the UA displayed in the *Max. UA* field to demonstrate compliance with the MEC.

% Better Than MEC

MECcheck compares the UA of your proposed house to the UA of the code house (the same house built to MEC requirements). This comparison is expressed as a percentage and displayed in the *% Better (Worse) Than MEC* field. The percentage gives an indication of the amount by which your house exceeds or fails code requirements. A green percentage indicates that your home's heat loss is less than that of the code house. A red percentage indicates that your home's heat loss exceeds that of the code house.

Building Components List

As you choose building components, a list of your choices is created and displayed on the *Building Description* screen. Almost all components in this list require an area or perimeter entry. Some components require a cavity R-value, a continuous R-value, and/or an assembly U-value. These entries are briefly described in this chapter.

Area or Perimeter You must enter an integer value representing the area or perimeter of each component in your building design. For wall components, enter the net opaque wall area (do not include windows and doors). For ceiling components, enter the net opaque ceiling area (do not include skylights). Slab floor components require a perimeter and must be entered in linear feet. The slab perimeter should include the area of all slab edges separating conditioned space from unconditioned space (i.e.,

along the building envelope). All other components require an area in square feet. You must enter a positive integer value in each *Area* or *Perimeter* field before compliance can be determined.

Cavity R-Value

Enter the R-value of the cavity insulation to be installed for each ceiling, wall, floor, and foundation component. Do not include the R-value of insulating sheathing (which is entered in the *Continuous R-Value* fields) or other materials (such as framing or structural sheathing).

- **Ceilings.** Provide the R-value of the cavity insulation to be installed. Blown ceiling insulation should be entered as cavity insulation, not continuous.
- **Walls.** Provide the R-value of the cavity insulation to be installed in wood- or metal-frame walls. For concrete and masonry walls, enter the R-value of cavity wall insulation to be installed between furring and integral insulation, such as the insulation-filled cores of masonry blocks. For log walls, the *Cavity R-Value* field is used for entering additional insulation (not the insulating value of the logs). If no additional insulation is installed, this field should remain zero (0). If insulation is installed in addition to the log walls, enter the R-value of the insulation only.
- **Floors.** Provide the R-value of the cavity insulation to be installed.
- **Basement Walls.** If the basement will be furred, provide the R-value of the insulation to be installed between furring.

Continuous R-Value

Enter the R-value of any continuous insulation (such as insulating sheathing) to be installed. Do not include the R-value of other materials (such as exterior siding, roofing, structural sheathing, and interior drywall). If no sheathing will be installed, enter zero. The following components have *Continuous R-Value* fields:

- **Ceilings.** For ventilated ceilings, insulating sheathing must be placed between the conditioned space and the ventilated portion of the roof (typically applied to the trusses or rafters immediately behind the drywall or other ceiling finish material). For stress-skin insulated ceiling panels and other premanufactured panels, enter the manufacturer-reported R-value for the entire assembly.
- **Walls.** For wood- and metal-frame walls, enter the R-value of exterior insulating sheathing. For concrete and masonry walls, enter the R-value of any continuous insulation installed. Insulation installed between furring or framing is not continuous and should be entered in the *Cavity R-Value* field. Insulation installed within hollow masonry blocks is also not continuous and should be entered in the *Cavity R-Value* field. For stress-skin insulated wall panels and other premanufactured panels, enter the manufacturer-reported test R-value for the entire assembly. The *Continuous R-Value* field is not available for log walls.

- **Basement Walls.** Continuous insulation includes exterior rigid foam products and any continuous insulation installed on the interior of an unfurred basement wall. If a basement wall is to be furred-in and insulation installed between the furring, it should be entered in the *Cavity R-Value* field. For specialty foundation systems, enter the manufacturer-reported R-value for the entire assembly.
- **Floors.** Provide the R-value of the continuous insulation to be installed. Do not include the R-value of construction materials, such as the subfloor.
- **Slab Floors.** Provide the R-value of the insulation to be installed around the slab perimeter. The slab perimeter should include the length of all edges of a slab foundation that are part of the building envelope and are less than 12 in. below grade (i.e. all edges separating conditioned space from unconditioned space).
- **Crawl Space Walls.** Provide the R-value of the insulation to be installed on the walls of unventilated crawl spaces.

Glazing/Door U-Value

1992 1993

For windows, doors, and skylights, enter the assembly U-value of each glazing and door component. U-values for glazing assemblies and opaque doors should be tested and documented by the manufacturer in accordance with the NFRC⁽²⁾ test procedure, taken from Appendix B, or derived from an alternate test procedure or table accepted by your local jurisdiction.

Glazing/Door U-Value

1995

For windows, doors, and skylights, enter the assembly U-value of each glazing and door component. U-values for glazing assemblies and opaque doors must be tested and documented by the manufacturer in accordance with the NFRC test procedure or taken from Appendix B.

UA

For ceilings, walls, floors, and foundations, the component's U-value is computed based on the cavity and continuous insulation. For glazing and doors, you are asked to enter the U-value directly into the *Glazing/Door U-Value* fields. Each component U-value is multiplied by its corresponding area to give a UA value (U-value x Area). The UA of each component is displayed in the far right column on the screen. You cannot directly alter the UA values. They are displayed to give you some indication of how each component impacts the total UA of your building. A large UA indicates the heat loss through that component is more significant than the heat loss through a component with a small UA.

(a) National Fenestration Rating Council, *NFRC 100-91: Procedure for Determining Fenestration Product Thermal Properties*.

Building Components

The buttons at the top of the *Building Description* screen are used for choosing the building components in your proposed design. You can select from buttons representing general building components -- ceilings, walls, glazing, doors, floors, basement walls, slab floors, and crawl space walls. When you select any of these buttons except the *Doors* button, you are prompted for more information about the component. After supplying this information, the component is added to the list displayed on the *Building Description* screen. A door entry does not require any additional information; therefore, selecting the *Doors* button causes a door component to be added directly to the building components list. The list continues to grow as you add new components. You may add as many components as you need to describe your building, including multiple components of the same type.

This chapter describes the building components that you will use to create your own building components list and the information you are asked to provide about each component.

The screenshot shows the 'Building Component Buttons' at the top: Ceilings, Walls, Basement, Glazing, Doors, Floors, Slab, Crawl, and Equipment. The 'Floors' button is selected, opening a dialog box titled 'Floors'. Inside the dialog, under 'Select the floor type(s):', two options are checked: 'Floor Over Unconditioned Space (i.e. over garage, crawl space, unconditioned basement)' and 'Floor Over Outdoor Air'. There are 'OK' and 'Cancel' buttons. Below the dialog, a note states: 'Insulation is not required for floors over insulated, conditioned basements, and such floors should not be included in the software.'

Below the dialog is the 'Building Components List' table:

	Net Area/ Perimeter	Cavity R-Value	Continuous R-Value	Glazing/Door U-Value	UA
FLOORS: Over Unconditioned Space	938	19	0		44
FLOORS: Over Outside Air	32	19	0		2
SLAB FLOORS: Unheated, 24.0" insul.	82		7		64

Figure 4. Adding Floor Components to the Building Components List

Ceilings

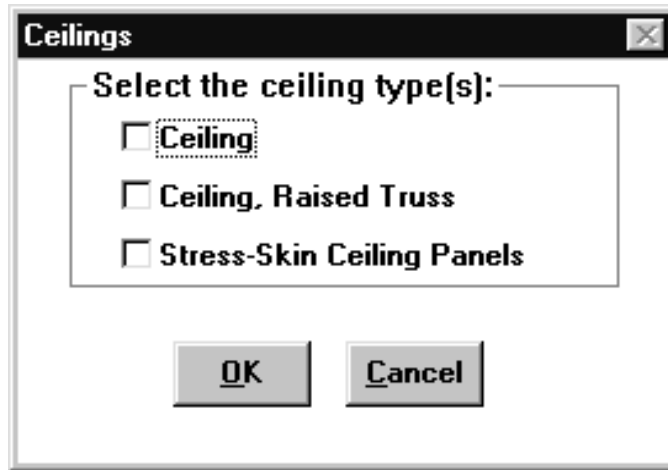


Figure 5. Ceilings Screen

When you select the *Ceilings* button, the *Ceilings* screen appears. Choose one or more ceiling types, then select the **OK** button to transfer them to your list of building components.

After creating a ceiling component, provide the net ceiling area in its corresponding area field (do not include the area of skylights). Ceiling area should be measured on the slope of the finished interior surface.

Enter the R-value of the insulation to be installed in each ceiling component in its corresponding *Cavity R-Value* field and enter the R-value of insulating sheathing (if used) in the *Continuous R-Value* field. Blown ceiling insulation should be entered as cavity insulation, not continuous. For ventilated ceilings, insulating sheathing must be placed between the conditioned space and the ventilated portion of the roof (typically applied to the trusses or rafters immediately behind the drywall or other ceiling finish material). Sheathing placed on the roof deck over a ventilated attic does not qualify. For stress-skin insulated ceiling panels, enter the manufacturer-rated R-value for the entire assembly in the *Continuous R-value* field.

To receive credit for a raised truss, the insulation must achieve its full thickness over the exterior walls.

Walls

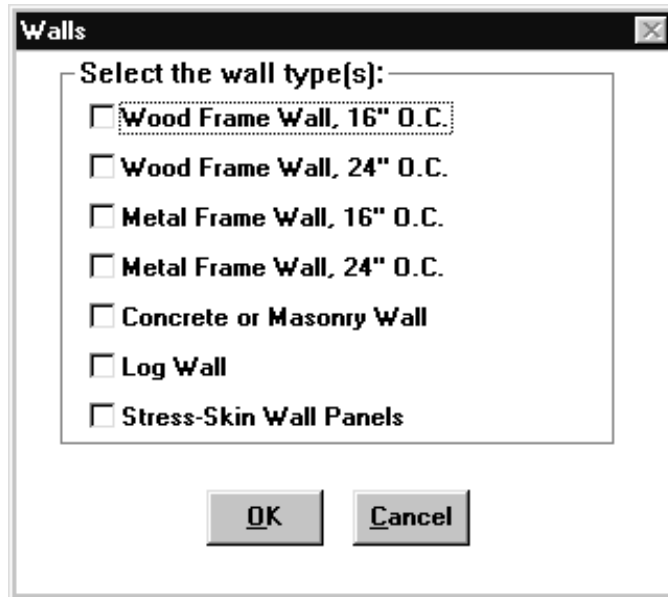


Figure 6. Walls Screen

When you select the **Walls** button, the *Walls* screen appears. Choose one or more wall types, then select the **OK** button to transfer them to your list of building components.

To qualify as a concrete, masonry, or log wall, the wall must have a heat capacity greater than or equal to 6 Btu/°F per ft² of exterior wall area (123 kJ/m²·°K). Masonry and concrete walls having a mass greater than or equal to 30 lb/ft² of exterior wall area (146 kg/m²) will meet this requirement. Solid wood walls having a mass greater than or equal to 20 lb/ft² of exterior wall area (98 kg/m²) will also meet this requirement.

Stress-skin wall panels are typically 4- to 6-in. stressed skin panels with foam insulation sandwiched between oriented strand-board (OSB).

After creating a wall component, provide the net wall area in its corresponding area field. The net wall area includes

- the opaque area of all above-grade walls enclosing conditioned spaces, excluding doors and windows
- the peripheral edges of floors (the area of the band joist and subfloor between floors)
- the opaque area of walls of conditioned basements with an average depth less than 50% below grade (excluding basement doors and windows but including the below-grade portion of the wall).

1992 1993

- 1995
- the opaque area of any individual wall of a conditioned basement with an average depth less than 50% below grade (excluding basement doors and windows but including the below-grade portion of the wall).

For further clarification refer to the basement wall examples given later in this guide.

Enter the R-value of the cavity insulation to be installed in each wall component in its corresponding *Cavity R-Value* field. Enter the R-value of the insulating sheathing to be installed (if any) in the *Continuous R-Value* field. For stress-skin panels, enter the manufacturer-reported test R-value for the entire assembly in the *Continuous R-value* field.

Glazing



Figure 7. Glazing Screen

When you select the **Glazing** button, the *Glazing* screen appears. Glazing is any translucent or transparent material in exterior openings, including windows, sliding-glass doors, patio doors, skylights, and glass block.

After choosing one or more glazing components, select the **OK** button to transfer them to your list of building components. If you need more than one entry of the same glazing type, repeat this process to add additional components. You are not required, however, to add a new component to your list for each glazing assembly in your building. All glazing assemblies with the same U-value can be entered as a single component by entering the sum of the glazing assembly areas into the corresponding area field.

After creating a glazing component, provide the area for each component in its corresponding area field. Glazing area is the interior surface area of the entire assembly, including glazing, sash, curbing, and other framing elements. The nominal area or rough opening is also acceptable for flat windows. The area of windows in the exterior walls of conditioned basements should be included. Windows in unconditioned basements are *NOT* included.

- 1992 1993 Enter the U-value for each component in its corresponding U-value field. U-values for glazing should be tested and documented by the manufacturer in accordance with the NFRC test procedure, taken from Appendix B, or derived from an alternate test procedure or table accepted by your local jurisdiction. Center-of-glass U-values cannot be used.
- 1995 Enter the U-value for each component in its corresponding U-value field. U-values for glazing must be tested and documented by the manufacturer in accordance with the NFRC test procedure or taken from Appendix B. Center-of-glass U-values cannot be used.

Doors

Select the **Doors** button to add a door component to your design. Each time the **Doors** button is selected, a new door component is added to the list. Enter the nominal door area or rough opening area of all exterior doors in the *Area or Perimeter* fields and the U-value for each door component in the *Glazing/Door U-value* field. Doors located in the walls of conditioned basements and doors separating a conditioned space from an unconditioned garage must be included.

If you need more than one door component, repeat this process to add additional components to the list. You are not required, however, to add a new component to your list for each door in your building. All doors with the same U-value may be entered as a single component by entering the sum of the door areas into the corresponding area field.

- 1992 1993 Door U-values must be based on manufacturer data, taken from Appendix B, or derived from an alternate test procedure or table accepted by your local jurisdiction.
- 1995 Door U-values must be tested and documented by the manufacturer in accordance with the NFRC test procedure or taken from Appendix B of this user's guide.

If the door is rated with an aggregate R-value (an R-value that includes both the glass and opaque area), the following equation applies:

$$U \text{ Value} = \frac{1}{R \text{ Value}}$$

If a door contains glass and an aggregate R-value or U-value rating for that door is not available, enter the door's glass area as a separate glazing component and enter the opaque door U-value and area as a door component. The U-values listed in Appendix B are only for doors without glass.

Floors

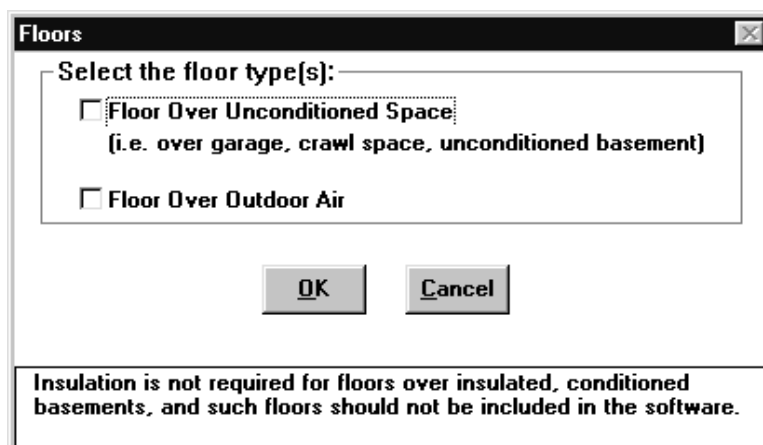


Figure 8. Floors Screen

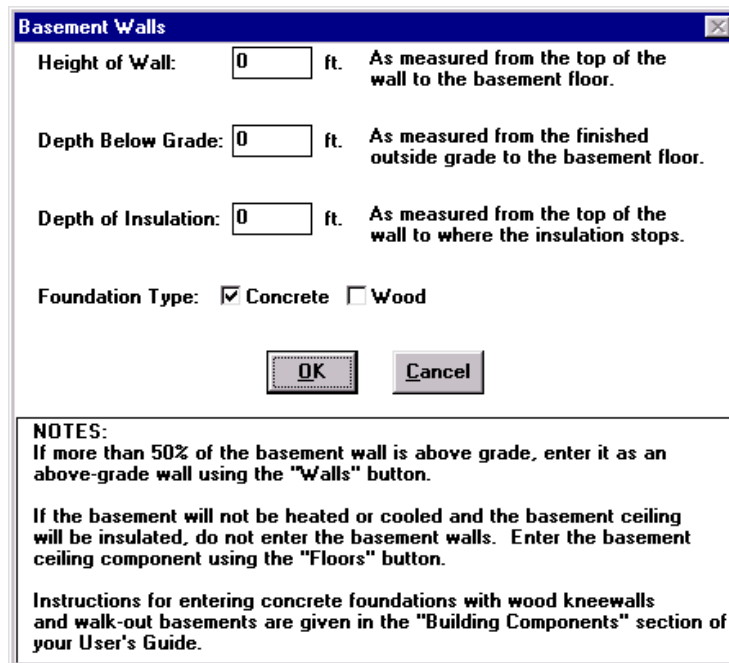
When you select the *Floors* button, the *Floors* screen appears. Floors over unconditioned space include all floors over unconditioned (neither heated nor cooled) basements, crawl spaces, and garages. Floors over outdoor air include floor cantilevers, floors of an elevated home, and floors of overhangs (such as the floor directly above a recessed entryway or open carport). Floors over heated spaces are not part of the building envelope and should not be included. See Appendix C for an explanation of the building envelope.

After creating a floor component, provide the floor area in its corresponding area field. Select one or more floor types, then select the *OK* button to transfer them to your list of building components. Enter the R-value of the insulation to be installed in each floor component in its corresponding R-value fields.

Basement Walls

When you select the *Basement* button, the *Basement Walls* screen appears.

- | | |
|-----------|---|
| 1992 1993 | Walls of conditioned basements with an average depth 50% or more below grade should be entered using the <i>Basement</i> button. Walls of conditioned basements with an average depth less than 50% below grade should be entered as an above-grade wall using the <i>Walls</i> button. |
| 1995 | Any individual wall of a conditioned basements with an average depth 50% or more below grade should be entered using the <i>Basement</i> button. Walls of conditioned basements with an average depth less than 50% below grade should be entered as an above-grade wall using the <i>Walls</i> button. |



Basement Walls

Height of Wall: 0 ft. As measured from the top of the wall to the basement floor.

Depth Below Grade: 0 ft. As measured from the finished outside grade to the basement floor.

Depth of Insulation: 0 ft. As measured from the top of the wall to where the insulation stops.

Foundation Type: ☒ Concrete ☐ Wood

OK Cancel

NOTES:
 If more than 50% of the basement wall is above grade, enter it as an above-grade wall using the "Walls" button.
 If the basement will not be heated or cooled and the basement ceiling will be insulated, do not enter the basement walls. Enter the basement ceiling component using the "Floors" button.
 Instructions for entering concrete foundations with wood kneewalls and walk-out basements are given in the "Building Components" section of your User's Guide.

Figure 9. Basement Walls Screen

The *Basement Walls* screen requires the following information:

Height of Wall Provide the height of the wall (ft) as measured from the top of the wall to basement floor. If the height is not uniform, provide an average height. If you are entering a partial basement wall component (such as wood kneewalls), enter the height of the wall section instead of the height of the entire wall.

Depth Below Grade Provide the depth (ft) that the wall extends from the finished grade surface to the basement floor. If the grade is sloped or uneven, provide an average depth below grade. If you are entering a partial basement wall component (such as wood kneewalls), enter the depth below grade of the wall section instead of the depth below grade of the entire wall. For wood kneewalls, the wall section may be entirely above grade, in which case you would enter 0.

Depth of Insulation The MEC basement insulation requirements are for the full depth of the basement wall (up to 10 ft). MECcheck, however, allows the depth of the basement wall insulation to be traded against other envelope components. Therefore, you must indicate the depth (ft) of the insulation you intend to install on your basement wall as measured from the top of the wall to where the insulation stops. The insulation must extend from the top of the basement wall downward to a depth equal to the value entered in this field. Note that for a fully insulated wall the depth of insulation

should be equal to the height of the wall. For basement walls with non-uniform insulation depths, enter an average. MECcheck accepts basement insulation depths from 0 to 10 ft. If you enter a depth of 0, the program assumes no insulation is to be installed and the R-value of your insulation is set to R-0.

Concrete Select the *Concrete* button if your basement walls will be concrete or masonry. If a combination of walls will be used, such as wood-framed and concrete walls for a walk-out basement, enter each different wall type as a separate component. A concrete foundation that is furred or framed should be entered as a concrete wall. The Wood option refers to all-wood foundations.

Wood Select the *Wood* button if your basement walls will be of all-wood construction. If a combination of walls will be used, such as wood-framed and concrete walls for a walk-out basement, enter each different wall type as a separate component.

After providing the above information, select the **OK** button to add this basement wall component to your list of building components. The information that you have entered in the *Basement Walls* screen will become part of the component description. If you later decide to change this information, move the cursor to the text description of the basement component and press **Enter**. The *Basement Walls* screen will reappear with the same information. Edit the information and select the **OK** button to replace the basement component with the new information.

After adding a basement wall component to your list, you must provide the basement opaque wall area (ft²) in the *Area or Perimeter* field. The area of basement windows and doors should not be included but, instead, should be entered using the *Glazing* and *Doors* buttons.

If the basement will be furred, provide the R-value of the insulation to be installed between furring in the *Cavity R-Value* field. Enter continuous insulation in the *Continuous R-Value* field. Continuous insulation includes exterior rigid foam products and any continuous insulation installed on the exterior or interior of an unfurred basement wall. For specialty foundation systems, enter the manufacturer-reported R-value for the entire assembly in the *Continuous R-Value* field.

Multiple Components: Uniform basement walls may be entered as a single component. If a wall has more than one cavity R-value, you should enter that wall as two separate basement wall components. In this case, provide the above information for each wall section as if it were a stand-alone wall. For example, enter the height of the wall section under consideration instead of the height of the entire wall. The following examples illustrate how to enter concrete foundations with wood kneewalls, walk-out basements, and basement walls constructed from specialty foundation systems.

Example 1: Wood Kneewalls

Assume a basement is to be constructed with 3-ft-high wood kneewalls built on a 5-ft-high concrete foundation. R-13 insulation will be installed in the wood kneewall cavities and R-5 rigid insulation will be installed on the concrete foundation walls.

The wood kneewalls are completely above grade and fully insulated. The concrete foundation walls are 4 ft below grade and fully insulated.

Create one basement wall component for the wood kneewalls and enter the following information:

- *Height of Wall* 3 ft
- *Depth Below Grade* 0 ft
- *Depth of Insulation* 3 ft.

Create a second basement wall component for the concrete foundation and enter the following information.

- *Height of Wall* 5 ft
- *Depth Below Grade* 4 ft
- *Depth of Insulation* 5 ft.

Two basement wall components will be added to your list of building components. Provide the opaque wall area of the wood kneewalls and enter the insulation R-value as R-13 in the *Cavity R-value* field. Provide the opaque wall area of the concrete foundation walls and enter the cavity R-value as R-5 in the *Continuous R-value* field.

Example 2: Walk-Out Basement

Assume an 8-ft basement is to be built on a slope so that the front wall is 7 ft below grade and the rear wall is totally above grade. The ground level along both side walls is sloped so that approximately 50% of each wall is below grade. The rear basement wall will be wood-frame construction with R-19 cavity insulation. The other three walls will be concrete walls with R-10 rigid insulation. All four walls will be fully insulated.

Create one basement component for the front wall and enter the following information:

- *Height of Wall* 8 ft
- *Depth Below Grade* 7 ft
- *Depth of Insulation* 8 ft.

The two side walls are at least 50% below grade, so they are entered as a basement wall component. If they were less than 50% below grade, they would be entered as an above-grade wall component. Therefore, create a second basement wall component for the two side walls and enter the following information:

- *Height of Wall* 8 ft
- *Depth Below Grade* 4 ft
- *Depth of Insulation* 8 ft.

The rear wall is fully above grade and should be entered as an above-grade wall using the **Walls** button. Note that the basement floor along this wall should be considered a slab-on-grade component. Create a slab component using the **Slab** button and enter the length of the basement floor along this wall in the *Area or Perimeter* field.

Example 3: Specialty Foundation Systems

Manufacturers of insulating foam concrete form systems and premanufactured concrete panels with integrated insulation generally supply R-value ratings for the entire wall, not just the insulation. The manufacturer overall wall R-value rating may be used in the *Continuous R-value* field.

Slab Floors

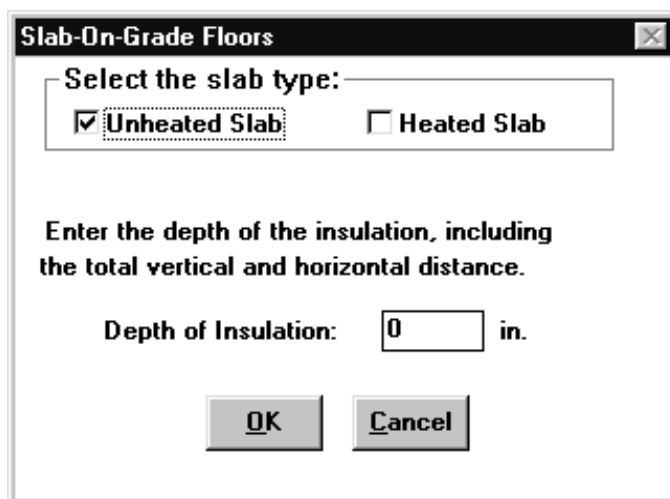
The image shows a software dialog box titled "Slab-On-Grade Floors". It has a standard Windows-style title bar with a close button. Inside the dialog, there is a section labeled "Select the slab type:" with two radio buttons: "Unheated Slab" (which is selected) and "Heated Slab". Below this, there is a text instruction: "Enter the depth of the insulation, including the total vertical and horizontal distance." Underneath this instruction is a label "Depth of Insulation:" followed by a text input field containing the number "0" and the unit "in.". At the bottom of the dialog are two buttons: "OK" and "Cancel".

Figure 10. Slab Floors Screen

When you select the **Slab** button, the *Slab Floors* screen appears. Select a heated or unheated slab. A heated slab is one in which the heating elements or hot air distribution system is in contact with or placed within the slab or the subgrade.

Depth of Insulation

In the *Depth of Insulation* field, you must provide the depth (in.) of the insulation you intend to install around your slab perimeter. Refer to the definition of Slab Insulation in Appendix A for a description and illustration of acceptable configurations.

MECcheck accepts slab insulation depths from 0 to 48 in. If you enter a depth of 0, the program assumes no insulation is to be installed and the R-value of your insulation is set to R-0.

After adding a slab component, provide the perimeter of the slab floor in its corresponding *Area or Perimeter* field and provide the R-value of the perimeter insulation in the *Continuous R-Value* field. The slab perimeter should include the length of all

edges of a slab foundation that are part of the building envelope and are less than 12 in. below grade (i.e. all edges separating conditioned space from unconditioned space).

Crawl Space Walls

Figure 11. Crawl Space Walls Screen

When you select the *Crawl* button, the *Crawl Space Walls* screen appears. The crawl space wall option is for walls of unventilated crawl spaces (i.e. not directly vented to the outside). The *Crawl Space Walls* screen requires the following information:

Height of Wall Provide the height of the wall (in.) as measured from the sill to the top of the footing.

Depth Below Grade Provide the depth (in.) that the wall extends from the outside finished grade surface to the top of the footing.

Depth of Insulation In the *Depth of Insulation* field, provide the depth (in.) of the insulation you intend to install as measured from the top of the wall to where the insulation stops. This distance should include the total vertical and horizontal distance (see the following illustration). Because the horizontal distance is included, the depth of insulation may be greater than the height of the wall. MECcheck accepts crawl space wall insulation depths from 0 to 84 in. If you enter a depth of 0, the program assumes no insulation is to be installed and the R-value of your insulation is set to R-0.

Concrete Select the *Concrete* button if your crawl space walls will be concrete or masonry.

Wood Select the *Wood* button if your crawl space walls will be of all-wood construction.

Select the **OK** button to add this crawl space wall component to your list of building components. The information that you have entered in the *Crawl Space Walls* screen will become part of the component description. If you later decide to change this information, move the cursor to the text description of the crawl space wall component and press **Enter**. The *Crawl Space Walls* screen will reappear with the same information. Edit the information and select the **OK** button to replace the component with the new information.

After adding a crawl space wall component to your list, you must provide the crawl space opaque wall area (ft²) in the *Area or Perimeter* field. The area should include the area of the entire wall as measured from the sill to the top of the footing, even if only a portion of the wall is insulated. Enter the R-value of the insulation to be installed in the *Continuous R-Value* field. For speciality foundation systems, enter the manufacturer reported R-value for the entire assembly.

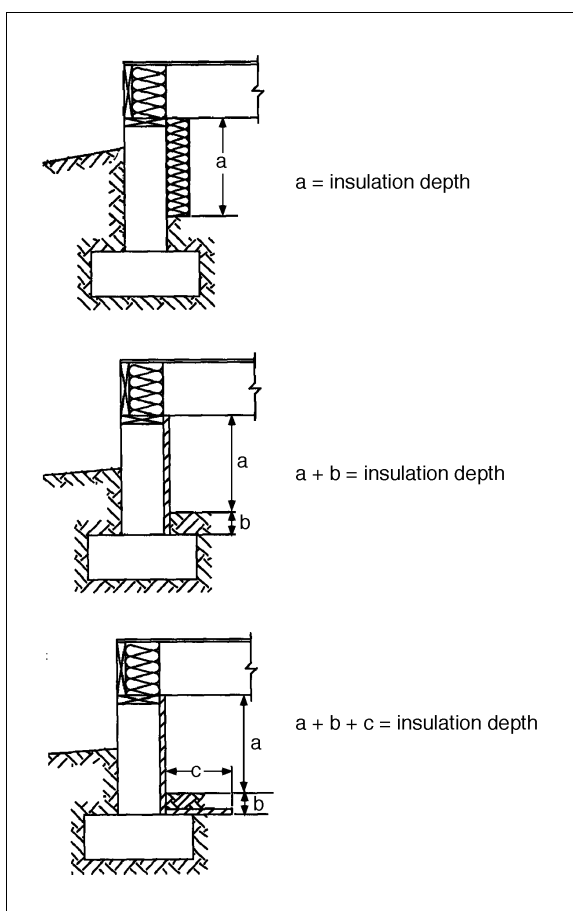


Figure 12. Crawl Space Wall Insulation Depth

HVAC Efficiency

When you select the *Equipment* button from the tool bar, the *Heating and Cooling Efficiency* screen appears. Trade-offs are allowed for efficient gas and oil furnaces, boilers, and electric heat pumps and air conditioners. No credit is given for electric resistance heating.

Minimum-required heating and cooling equipment efficiencies set by NAECA⁽³⁾ are displayed in the right-hand column of the screen. If the equipment you plan to install exceeds these minimums, you qualify for the high-efficiency equipment credit. Type the annual fuel utilization efficiency (AFUE), heating seasonal performance factor (HSPF), or seasonal energy efficiency ratio (SEER) in the appropriate space.

You can receive credit for only one piece of heating equipment and one piece of cooling equipment (or a single heat pump). If you plan to install more than one piece of heating equipment or more than one piece of cooling equipment, you must enter the efficiency of the equipment with the lowest rating.

After entering the efficiency of your equipment, select the **OK** button. The HVAC efficiency trade-off line is then added to your building components list, displaying the efficiency of your equipment.

The high-efficiency equipment credit is applied as a percent increase in the code house UA. To see how much credit you are getting, observe the UA value displayed in the *Max. UA* field. The UA will probably be smaller before taking the credit than after. Some locations along the California coast do not qualify for the cooling equipment credit.

		Minimum
FURNACE	AFUE <input type="text" value="0"/>	78.0
BOILER: Except Gas Steam	AFUE <input type="text" value="0"/>	80.0
BOILER: Gas Steam	AFUE <input type="text" value="0"/>	75.0
HEAT PUMP:		
Heating Mode	HSPF <input type="text" value="0"/>	6.8
Cooling Mode	SEER <input type="text" value="0"/>	10.0
AIR CONDITIONER	SEER <input type="text" value="0"/>	10.0

No trade-off available for electric resistance heating.

Figure 13. Heating and Cooling Efficiency Screen

(3) The National Appliance Energy Conservation Act of 1987, 42 USC 6291 et seq., as amended, Public Law 100-12.

Menus

The Menu Bar located at the top of the *Building Description* screen is used to select the *File*, *Project*, *Options*, and *Help* menus.

File Menu

The data you enter into MECcheck can be stored on your hard disk in a project data file. Separate data files can be created for different building projects or for alternate designs of the same project. Data files allow you to retrieve and alter designs at any time. Report files allow you to print the information you have entered and to document the compliance results determined by MECcheck. The *File* menu contains options allowing you to create (*New*), retrieve (*Open*), and save project data files and to create project reports.

In this guide, filename refers to a standard DOS filename, which can be up to eight characters in length with an extension of up to three characters. Data files created by MECcheck must have the extension .CCK, and report files must have the extension .RPT. If you prefer, when you are asked to provide a filename, you may leave the extensions off and let MECcheck enter them for you.

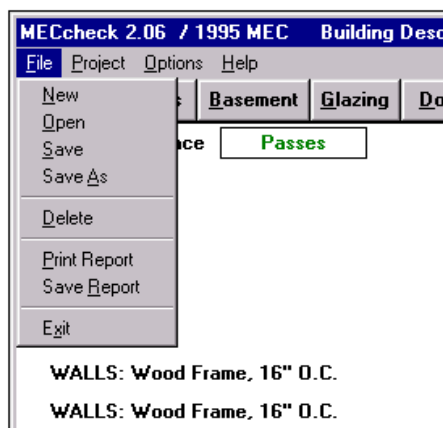


Figure 14. File Menu

New

The *New* option allows you to erase the current data and begin a new project data file. When you select *New*, MECcheck asks if you wish to save the current data. Select *Yes* to save the current data or *No* if you do not want to save the current data. If you select *Yes* and a file is already open, the open file is updated to contain the current data. If no file is open, the *Files* screen appears and you are asked for a filename to which the data will be saved.

Open

When you want to revise or examine an existing file, you must retrieve a copy of the file by bringing it to the screen. This is referred to as *opening* the file. The *Open* option allows you to open an existing project data file. When you select *Open*, the *Files* screen appears and you are asked for the filename of the project data file to retrieve (see the next section for additional information about the *Files* screen). If an

existing file is already open, you are asked if you wish to save the currently open file before opening another file.

- Save** The **Save** option allows you to save your current data to the filename shown on the Title Bar. If no file is open, the *Files* screen appears and you are asked for a filename.
- Save As** The **Save As** option allows you to save your current project data file to a new name. This option is useful when an existing file is opened then modified. If you want to save copies of both the original and modified file, use **Save As** to rename the modified file.
- Delete** The **Delete** option allows you to erase a previously created project data file. When you select **Delete**, the *Files* screen appears and you are asked for the name of the file to be deleted.
- Print Report and Save Report** The **Print Report** and **Save Report** options allow you to generate a report listing project data and compliance results.
- Exit** The **Exit** option allows you to exit MECcheck.

Project Menu

The **Project** menu is used to bring up the *Required Information* and *Optional Information* screens.

Required Information

When you select **Required Information**, you are asked to provide your building's location and construction type (single family or multifamily). This information DOES affect the compliance determination, so be sure it is correct.

Optional Information

When you select **Optional Information**, you are asked to provide general information about your project. None of this information affects the compliance determination. All of the information entered in this screen will be included in your reports.

Options Menu

The **Options** menu is used to select the MEC edition.

1992 MEC Compliance

1993 MEC Compliance

1995 MEC Compliance

The MEC compliance options are used to select the MEC edition applicable to your jurisdiction; 1992, 1993, or 1995 MEC.

Help Menu

The **Help** menu provides general information on how to use MECcheck. The **Help Index** screen is displayed either by selecting **Help**→**Index** or by pressing the **Show Index** button displayed on every help window. The **Help Index** screen is slow to be displayed the first time it is used, but it is quickly displayed thereafter.

Action Keys

The **Action Keys** option displays the keys used to run MECcheck.

Index

The **Index** option brings up a submenu containing a list of help topics.

About MECcheck

The **About MECcheck** option displays the program's version number and release date.

Files

The **Files** screen is used to indicate the names of files and reports you create, open, delete, and print. The **Files** screen is displayed whenever you select **Open**, **Save As**, and **Delete** from the **File** menu. If a file is not currently open, the **Files** screen is displayed when you select **Save** from the **File** menu. If you choose **Save Report** from the **File** menu, the **Files** screen is also displayed.

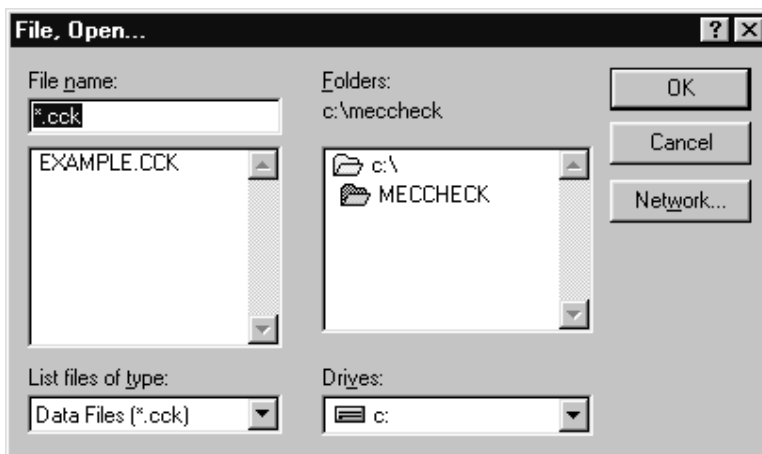


Figure 15. Files Screen

File name

The **File name** field at the top of the screen is a text field used to enter a filename with up to 8 characters plus an extension (such as .CCK). Type in a filename by moving the cursor to the **File name** field and entering the name of the file you wish to open, save, or delete. Alternatively, you may select an existing file from the files list located directly below the **File name** field. The files list contains the names of all files found in the current directory matching the filename template shown in the **List files of type** field.

Once your filename is selected and displayed in the *File name* field, select the **OK** button to accept your choice. Alternatively, you can double click the mouse on the desired name in the files list box. This has the same effect as clicking once on the filename and then on the **OK** button.

All data files must have an .CCK extension, and all report files must have an .RPT extension. If you omit the extension when entering a filename, MECcheck automatically adds the correct extension for you. When you select file options that apply only to data files (*Open*, *Save*, *Save As*, and *Delete*), the files list will only contain files that end with the .CCK extension. When you select file options that apply only to report files (*Save Report*), the files list will only contain files that end with the .RPT extension.

<i>Drives</i>	The <i>Drives</i> list is used to change drives. This feature is used to store and retrieve files in other drives on your computer.
<i>Folders</i>	The <i>Folders</i> list is used to change folders. This feature is used to store and retrieve files in other folders on your computer.
<i>List files of type</i>	This drop-down list is used to control the list of files displayed directly above it. Files displayed in the files list must match the "template" shown in this field. For example, if the <i>List files of type</i> field reads *.CCK, only files ending with the extension .CCK are listed in the file list.
<i>OK</i>	Select the OK button to choose the file displayed in the <i>File name</i> field.
<i>Cancel</i>	Select the <i>Cancel</i> button to exit this screen without altering any files.
<i>Network</i>	Select the <i>Network</i> button to connect to a network share.

MECcheck Files From Previous Versions

MECcheck Version 2.07 data files use a .CCK extension. Earlier MECcheck versions (2.0 and before) used an .MEC extension for data files. These earlier files can be read into MECcheck 2.07. To read in an older file, use the *File->Open* option to display the *Files* screen. Make sure the folder containing the desired file is current. Type the file's full name (including the extension) into the *File name* field and press **Enter**. Alternatively, you can select *All Files (*.*)* from the *List files of type* field and select the desired file from the scrolling list of files that is displayed.

Compliance Example

The software approach is illustrated in this section. Assume that you plan to build the single-family house shown below on a lot located in Greensboro, North Carolina.

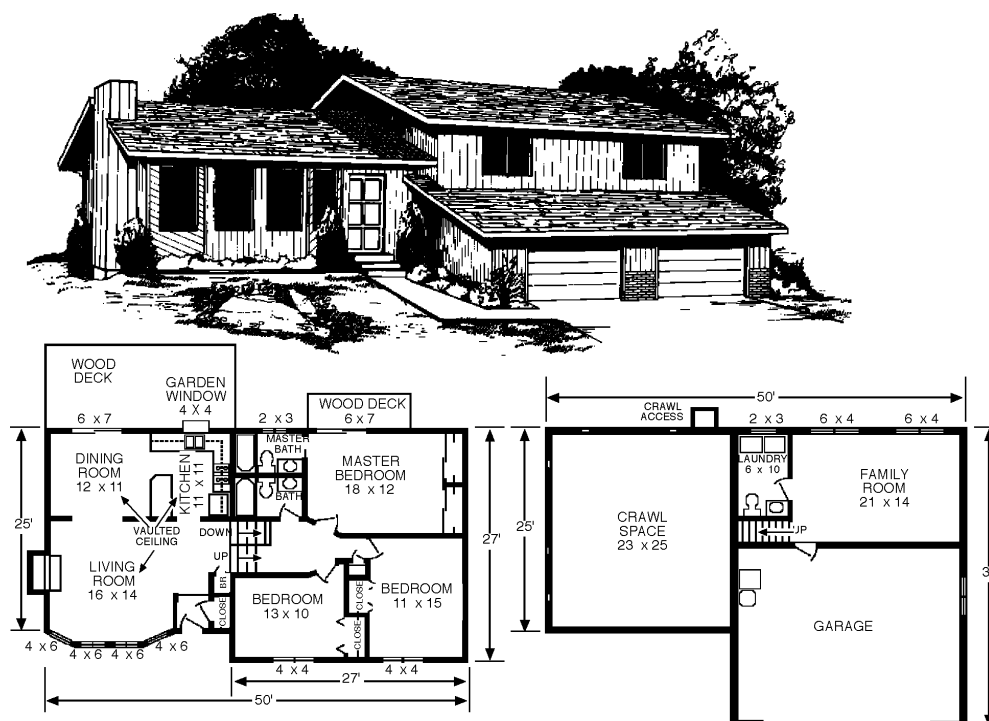


Figure 16. Example House

Table 1 lists the components that make up the building envelope, the dimensions of some of these components, and the proposed insulation R-values and window and door U-values. To determine compliance, you only need to input the areas, R-values, and U-values listed in this table into the software, which will then display the compliance results in the *MEC Compliance* field. If desired, you can then alter any or all of these inputs to determine if a revised design still complies with the MEC.

Determine Which Components Are Part of the Building Envelope

Only the building components that are part of the building envelope are considered for MEC compliance. Building envelope components are those that separate conditioned spaces (heated or cooled rooms) from outside air or from unconditioned spaces (rooms that are neither heated nor cooled). Walls, floors, and other building components separating two conditioned spaces are *NOT* part of the building envelope.

Table 1. Example House Specifications

Building Component	Area	Insulation Level
Ceilings		
With Attic (Std. Truss)	729 ft ²	R-38
Vaulted	592 ft ²	R-30
Walls (2x4 @ 16-in. O.C.)		
Without Sheathing ^(a)	276 ft ² (gross)	R-13
	258 ft ² (net)	
With Sheathing	1647 ft ² (gross)	R-19
	1339 ft ² (net)	(R-13 cavity + R-6 sheathing)
Windows	204 ft ²	U-0.45
Sliding Glass Doors	84 ft ²	U-0.61
Doors		
Entrance	20 ft ²	U-0.54
Garage to Family Room	18 ft ²	U-0.35
Floors		
Over Garage	363 ft ²	R-19
Over Crawl Space	575 ft ²	R-19
Slab (Unheated)	82 ft (perimeter)	R-8 (24-in. depth)
Bay Window Floor	32 ft ²	R-30
(a) Walls without sheathing are located between the family room and the garage, the laundry room and the crawl space, and the garage and the living room.		

Walls In this example, the garage is unconditioned, so the exterior garage walls are not part of the building envelope. The wall between the conditioned family room and the unconditioned garage is part of the building envelope, including the wall of the stairwell facing the garage. Likewise, the wall between the garage and the living room is part of the building envelope.

Part of the laundry room wall separates the laundry room from the crawl space and the other part separates the laundry room from the kitchen. The wall portion adjacent to the crawl space is part of the building envelope because it separates the conditioned laundry from the unconditioned crawl space. The wall portion adjacent to the kitchen can be ignored because it separates two conditioned spaces. The wall portion adjacent to the family room can also be ignored. Likewise, the wall between the upstairs bathrooms and the kitchen and the wall between the center bedroom and the living room are not part of the building envelope. Portions of both of these walls are also adjacent to outside air, and those portions are part of the building envelope. Table 2 lists the walls that are part of the building envelope and indicates whether sheathing is installed on them (which is relevant when determining the R-value of the wall).

Table 2. Walls Comprising the Building Envelope

Wall	Sheathing?	Gross Area	Net Area ^(a)
All walls between interior conditioned space and outside air	Yes	1647	1339
The wall between the family room and the garage	No	192	174
The wall between the garage and the living room	No	44	44
The wall between the laundry and the crawl space	No	40	40
(a) Net area does not include doors or windows.			

Ceilings The dining room, living room, bay window roof, and entryway have a vaulted ceiling that will be insulated to R-30. The area covered by the vaulted ceiling totals 592 ft². The rest of the home has a ceiling with attic which will be insulated to R-38. Since these two ceiling areas will be insulated to different levels, they must be treated as two separate building components.

Floors The example house has a conditioned floor area of 1714 ft², but 378 ft² of the floor area is located over the family room and is not part of the building envelope (both the family room and the rooms above it are conditioned). The living room, dining room, and kitchen are over an unheated crawl space. The family room and garage both have slab-on-grade floors. The floor of the bay window is a floor over outside air.

Glazing and Doors There are two sliding glass doors in the building envelope -- one leading from the dining room to the larger deck and one leading from the master bedroom to the smaller deck. There are two opaque doors in the building envelope -- the front entry door and the door leading from the garage into the family room.

Enter the Location

Select *Required Information* under the **Project** menu. Enter the location of the building and the type of construction. Enter the city and state as Greensboro, North Carolina, and the construction type as *Single Family*. Select the **OK** button.

Select the Code Year

This example is based on compliance with the 1995 MEC. Select the *1995 MEC* option from the **Options** menu at the top of the *Building Description* screen.

Create the Building Components List

Using the buttons at the top of the *Building Description* screen, create building components for the entries in Table 1. If you need more than one building component of the same type, you must enter each component separately. For example, you will need two different ceiling components since there are two different ceiling insulation R-values used in the example house. Select the *Ceilings* button, choose *Ceiling* from the list of ceiling types, and select the **OK** button. This creates the first ceiling component. Repeat these same steps to create a second ceiling component. Create two 16" O.C. wood-framed wall components, two glazing components, two door components, two floor components (one *Floor Over Unconditioned Space* and one *Floor Over Outside Air*), and one slab component with 24" depth of insulation. There are actually two *Floor Over Unconditioned Space* components in Table 1, but they can be combined since they both have the same R-value (R-19).

After the building components list has been created, fill in the areas, R-values and U-values from Table 1. Note that all wall areas entered into the software must represent net areas -- windows and walls must be subtracted out of the gross wall area. Table 1 lists net wall areas as 258 ft² for the walls without sheathing and 1339 ft² for the walls with sheathing. All ceiling areas entered into the software must also be net areas -- skylights must be subtracted out of the gross ceiling area. Since there are no skylights in this example, the gross ceiling area and net ceiling area are the same.

If the building has been correctly created, the *MEC Compliance* field should display the word *Passes* in green letters. The *Max. UA* field should show a total required UA of 468, and the field labeled *Your UA* should show a proposed UA of 415.

Save and Print a Report

Save the data you have entered by selecting the *Save* option from the *File* menu. You will be asked to provide a name for the data file. Print a compliance report by selecting the *Print Report* option from the *File* menu. You can exit MECcheck by selecting the *Exit* option from the *File* menu.

Check Your Work

An example file (EXAMPLE.CCK) has been included with the MECcheck software. EXAMPLE.CCK is a data file which contains the same data used in this example. If you have any questions, the example file can be loaded into the software to show how the building used in this example should be entered into the software. To load this file, select the *Open* option from the *File* menu.

Changing Location Files

The following text provides instructions for changing from the city version of the MECcheck software to the county version.

The MECcheck software contains three location files:

- 1) The CITIES file contains a list of cities for each state.
- 2) The COUNTIES file contains a list of counties for each state.
- 3) The LOCATION.MEC file is the file that is actually used by the software. By default, the LOCATION.MEC file is identical to the CITIES file. When you start the software you will be presented with a list of cities.

Changing to Counties

If you prefer to use the county version, copy the COUNTIES file into the LOCATION.MEC file.

Changing Back to Cities

To change back to the cities version, copy the CITIES file back into the LOCATION.MEC file.

Noteworthy...

If you have saved a data file for a building, the location for that building is also saved. If you subsequently change the LOCATION.MEC file as described above and try to load that data file back into the MECcheck software, MECcheck will not find the specified building location and will set the location to a default. Therefore, after loading the file into the program, you must go back to the *Required Information* screen and reselect your location.

Modifying the Cities or Counties

MECcheck accesses a list of cities or counties, depending on which version you are using. The cities are stored in a file named CITIES and the counties are stored in a file named COUNTIES. These files come with the MECcheck software and should be located in the same directory as the MECcheck executable file (MECCHECK.EXE).

The software uses a file named LOCATION.MEC, which will be identical to either the CITIES file or the COUNTIES file. The first line of the CITIES file contains the

word **cities* and the first line of the COUNTIES file contains the word **counties*. This keyword tells the software whether cities or counties are currently contained in the LOCATION.MEC file, and should not be changed. The following text and illustration apply to the cities version. However, modifications can be made to the counties version in exactly the same manner.

The CITIES file begins with an alphabetical list of the states. The second line of the file contains an asterisk (*) followed by the word *states*. All asterisks are very important because they delineate the sections of the file.

The list of states is followed by lists of cities for each state. The cities for each state are listed separately, starting with the cities for Alabama. The Alabama cities start directly after the line reading **Alabama*.

Each city name is followed by fifteen climate values that apply to that city. The first value represents the heating degree-days base 65°F (HDD), and the second value represents the cooling degree-days base 65°F (CDD). Commas are used to separate the city name and climate values. Commas MAY NOT be used as part of a city name. Remove extra space on either side of all commas.

```
*cities
*states
Alabama
Alaska
Arizona
.
.
.
Wisconsin
Wyoming
*Alabama
Andalusia,2450,1944,10,1.29,0.95,1.078,65,6.78,5.14,9.73,20.19,1.061,0.76,1541,F
Anniston,2854,1787,3,1.00,0.96,1.058,62,6.78,5.14,9.73,20.19,1.060,0.69,1388,T
.
.
.
Union Springs,2481,2000,10,1.28,0.99,1.078,65,6.78,5.14,9.73,20.19,1.061,0.69,1388,F
Valley Head,4107,1118,3,1.29,0.81,1.058,62,6.78,5.14,9.73,20.19,1.060,0.64,1420,F
*Alaska
Adak,8881,0,21,1.34,1.00,1.306,40,3.93,6.02,13.64,33.05,0.604,1.16,268,F
Anchorage,10570,0,21,1.24,1.00,1.306,40,3.93,6.02,13.64,33.05,0.604,0.87,268,F
.
.
.
Wrangell,8056,14,21,1.00,1.00,1.306,40,3.93,6.02,13.64,33.05,0.604,0.94,1714,F
Yakutat,9485,0,21,1.00,1.00,1.306,40,3.93,6.02,13.64,33.05,0.604,0.95,268,F
*Arizona
.
.
.
etc.
```

Figure 17. Cities File

If the CITIES or COUNTIES file is edited, care must be taken to save the new data in text (ASCII) format. To preserve this format, use a DOS text editor, such as EDIT.COM. If a text processor such as Word Perfect or Microsoft Word is used, save the file as DOS text or ASCII text. Copy the edited file to LOCATION.MEC.

To add, delete, or modify cities:

- 1) Find the list of cities you wish to modify.
- 2) Add, delete, or modify as many city lines as you wish. Each new line must adhere to the format described above. To add a new city, find the city in the file closest in location and weather to the city you want to add. Copy the existing city line to the correct alphabetical location for the new city. Change the city name to the new city name. You may modify the HDD and/or CDD values to match the new city values, if known. Do not modify any of the other climate data.

To delete an entire state:

- 1) Delete the state name from the list of states located at the beginning of the file.
- 2) Delete the list of cities corresponding to that state. Be sure to delete all cities AND the name of the state which precedes them.

Appendix A

Definitions

Addition	The MEC applies to new residential buildings and additions to existing buildings. Additions can be shown to comply by themselves without reference to the rest of the building. Alternatively, the entire building (the existing building plus the new addition) can be shown to comply.
1992 1993 Basement Wall	Basement walls that enclose conditioned spaces are part of the building envelope. Basement wall refers to the opaque portion of the wall (excluding windows and doors). To be considered a basement wall, at least 50% of the total wall area (including openings) must be below grade. For walls less than 50% below grade, include the entire opaque wall area as part of the above-grade walls.
1995 Basement Wall	Basement walls that enclose conditioned spaces are part of the building envelope. Basement wall refers to the opaque portion of the wall (excluding windows and doors). To be considered a basement wall, at least 50% of the wall's total wall area (including openings) must be below grade. Treat walls on each side of the basement individually when determining if they are above grade or basement walls. For any individual wall less than 50% below grade, include the entire opaque wall area of that individual wall as part of the above-grade walls.
Building Envelope	The building envelope includes all components of a building that enclose conditioned spaces (see the definition of conditioned space). Building envelope components separate conditioned spaces from unconditioned spaces or from outside air. For example, walls and doors between an unheated garage and a living area are part of the building envelope; walls separating an unheated garage from the outside are not. Although floors of conditioned basements and conditioned crawl spaces are technically part of the building envelope, the MEC does not specify insulation requirements for these components and they can be ignored.
Ceiling	The ceiling requirements apply to portions of the roof and/or ceiling through which heat flows. Ceiling components include the interior surface of flat ceilings below attics, the interior surface of cathedral or vaulted ceilings, and skylights.
Conditioned Space	A space is conditioned if heating and/or cooling is deliberately supplied to it or is indirectly supplied through uninsulated surfaces of water or heating equipment or through uninsulated ducts. For example, a basement with registers or heating devices designed to supply heat is conditioned. An indirectly heated basement is also conditioned if the basement ceiling is not insulated and heat is indirectly supplied to the space, such as through uninsulated ducts or through uninsulated surfaces of water heaters or space heating equipment.

Crawl Space	The MECcheck crawl space wall insulation requirements are for the exterior walls of unventilated crawl spaces (i.e. not directly vented to the outside) below uninsulated floors. A crawl space wall component includes the opaque portion of a wall that encloses a crawl space and is partially or totally below grade, as measured from the sill to the top of the footing.
Door	Doors include all openable opaque assemblies located in exterior walls of the building envelope. Doors with glass can be treated as a single door assembly, in which case an aggregate U-value (a U-value that includes both the glass and opaque area) must be used; OR the glass area of the door can be included with the other glazing and an opaque door U-value can be used to determine compliance of the door.
Dwelling Unit	A single housekeeping unit of one or more rooms providing complete, independent living facilities, including permanent provisions for living, sleeping, eating, cooking and sanitation.
Envelope	See Building Envelope
Floor Area	<p>Not all floors in a building are considered when computing the floor area for compliance purposes:</p> <ul style="list-style-type: none">• Floors over unconditioned spaces (such as floors over an unheated garage, basement, or crawl space) must be insulated and the area of these floors must be included.• Floors over outside air (such as floors of overhangs and floors of an elevated home) must also be insulated and the areas of these floors must be included.• In most locations, slab-on-grade floors of conditioned spaces must be insulated along the slab perimeter. The area of the slab floor is not required for MECcheck compliance, but the slab perimeter must be included.• Floors of basements and crawl spaces are not subject to an insulation requirement and do not have to be included as a building envelope component, even if the basement or crawl space is conditioned. In some cases, however, crawl space wall insulation is required to extend down from the top of the wall to the top of the footing and then horizontally a short distance along the floor.• Floors separating two conditioned spaces are not subject to an insulation requirement and do not have to be included as a building envelope component.
Glazing	Glazing is any translucent or transparent material in exterior openings of buildings, including windows, skylights, sliding glass doors, the glass areas of opaque doors, and glass block.

Glazing Area	The area of a glazing assembly is the interior surface area of the entire assembly, including glazing, sash, curbing, and other framing elements. The nominal area or rough opening is also acceptable for flat windows and doors.
1992 1993	
Gross Wall Area	The gross wall area includes the opaque area of above-grade walls, the opaque area of walls of conditioned basements less than 50% below grade (including the below-grade portions), all windows and doors (including windows and doors of conditioned basements), and the peripheral edges of floors.
1995	
Gross Wall Area	The gross wall area includes the opaque area of above-grade walls, the opaque area of any individual wall of a conditioned basement less than 50% below grade (including the below-grade portions), all windows and doors (including windows and doors of conditioned basements), and the peripheral edges of floors.
Multifamily	A multifamily building is a residential building three stories or less in height that contains three or more attached dwelling units. Multifamily buildings include apartments, condominiums, townhouses, and rowhouses. Hotels and motels are considered commercial rather than residential buildings.
Net Wall Area	The net wall area includes the opaque wall area of all above-grade walls enclosing conditioned spaces, the opaque area of conditioned basement walls less than 50% below grade (including the below-grade portions), and peripheral edges of floors. The net wall area does not include windows, doors, or other such openings, as they are treated separately.
Opaque Areas	Opaque areas as referenced in this guide include all areas of the building envelope except openings for windows, skylights, doors, and building service systems. For example, although solid wood and metal doors are opaque, they should not be included as part of the opaque wall area (also referred to as the net wall area).
Raised Truss	Raised truss refers to any roof/ceiling construction that allows the insulation to achieve its full thickness over the exterior walls. Several constructions allow for this, including elevating the heel (sometimes referred to as an energy truss, raised-heel truss, or Arkansas truss), use of cantilevered or oversized trusses, lowering the ceiling joists, or framing with a raised rafter plate.
R-Value	R-value ($\text{h} \cdot \text{ft}^2 \cdot ^\circ\text{F} / \text{Btu}$) is a measure of thermal resistance, or how well a material or series of materials resists the flow of heat. R-value is the reciprocal of U-value:
	$R \text{ Value} = \frac{1}{U \text{ Value}}$
Single Family	As defined by the MEC, a single-family building is a detached one- or two-family residential building, irrespective of height.

Slab Edge

Slab edge refers to the perimeter of a slab-on-grade floor, where the top edge of the slab floor is above the finished grade or 12 in. or less below the finished grade. The slab perimeter should include the length of all edges of a slab foundation that are part of the building envelope and are less than 12 in. below grade (i.e. all edges separating conditioned space from unconditioned space).

The insulation can be installed using any of the following configurations, but in all cases it must start at the top of the slab:

- The slab insulation extends from the top of the slab downward to the required depth.
- The slab insulation extends from the top of the slab downward to the bottom of the slab and then horizontally underneath the slab for a minimum total linear distance equal to or greater than the required depth.
- The slab insulation extends from the top of the slab downward to the bottom of the slab and then horizontally away from the slab for a minimum total linear distance equal to or greater than the required depth. The horizontal insulation must be covered by pavement or at least 10 in. of soil.

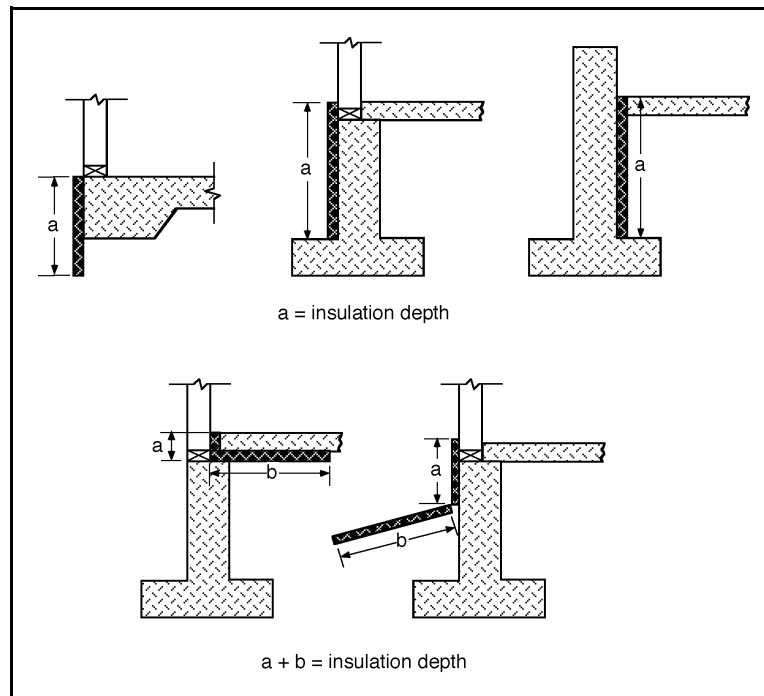


Figure A-1. Slab Insulation Depth Requirement

The top edge of insulation installed between the exterior wall and the interior slab can be cut at a 45° angle away from the exterior wall.

U-Value

U-value (Btu/h·ft²·°F) is a measure of how well a material or series of materials conducts heat. U-values for window and door assemblies are the reciprocal of the assembly R-value:

$$U \text{ Value} = \frac{1}{R \text{ Value}}$$

For other building assemblies (such as a wall), the R-value used in the above equation is the R-value of the entire assembly, not just the insulation.

Appendix B

Glazing and Door U-Values

The glazing and opaque door U-value tables provide default U-values for glazing and doors based on the glazing or door features. The U-values in these tables can be used in the absence of NFRC-labeled U-values.

Glazing and doors cannot receive credit for features that cannot be clearly detected, such as argon gas fills and low-emissivity (low-E) coatings. Windows with these features may achieve much lower U-values than those listed in Table B-1. For example, a double-pane wood or vinyl window with low-E glass may have a U-value around 0.38. The same window with argon gas may be rated at 0.34. Therefore, it may be advantageous to use test U-values for these types of windows.

Where a composite of materials from two different product types is used, the window or door must be assigned the higher U-value.

Table B-1. U-Values for Windows, Glazed Doors, and Skylights

Frame/Glazing Features	Single Pane	Double Pane
Metal Without Thermal Break		
Operable	1.30	0.87
Fixed	1.17	0.69
Door	1.26	0.80
Skylight	2.02	1.30
Metal With Thermal Break		
Operable	1.07	0.67
Fixed	1.11	0.63
Door	1.10	0.66
Skylight	1.93	1.13
Metal-Clad Wood		
Operable	0.98	0.60
Fixed	1.05	0.58
Door	0.99	0.57
Skylight	1.50	0.88
Wood/Vinyl		
Operable	0.94	0.56
Fixed	1.04	0.57
Door	0.98	0.56
Skylight	1.47	0.85
Glass Block Assemblies	0.60	

Table B-2. U-Values for Non-Glazed Doors

Steel Doors		
Without Foam Core	0.60	
With Foam Core	0.35	
Wood Doors	Without Storm	With Storm
Panel With 7/16-in. Panels	0.54	0.36
Hollow Core Flush	0.46	0.32
Panel With 1 1/8-in. Panels	0.39	0.28
Solid Core Flush	0.40	0.26

The Building Envelope

The MEC requirements are intended to limit heat loss and air leakage through the building envelope. The building envelope includes all of the building components that separate conditioned spaces (conditioned space is defined in Appendix A) from unconditioned spaces or from outside air. For example, the walls and doors between an unheated garage and a living area are part of the building envelope; the walls separating an unheated garage from the outside are not. Walls, floors, and other building components separating two conditioned spaces (such as an interior partition wall) are *NOT* part of the building envelope, nor are common or party walls which separate dwelling units in multifamily buildings.

You can think of the building envelope as the boundary separating the inside from the outside and through which heat is transferred. Areas that have no heating or cooling sources are considered to be outside the building envelope. A space is conditioned if heating and/or cooling is deliberately supplied to it or is indirectly supplied through uninsulated surfaces of water or heating equipment or through uninsulated ducts.

To use the MEC*check*[™] materials, you must specify proposed insulation levels for ceiling, wall, floor, basement wall, slab-edge, and crawl space wall components located in the building envelope. In some cases, it may be unclear how to classify a given building element. For example, are skylight shafts considered a wall component or a ceiling component? The following table can be used to help determine how a given building envelope assembly should be entered in the MEC*check*[™] materials.

Table C-1. Building Envelope Components

Ceiling Components

Ceiling	Flat ceilings Cathedral or vaulted ceilings Dormer roofs Bay window roofs Overhead portions of an interior stairway to an attic Attic hatches
Floors Over Outside Air ^(a)	Floors of overhangs (such as the floor above a recessed entryway or carport) Floor cantilevers Floors of an elevated home Bay window sill
Skylights	Skylight assemblies
(a) The insulation requirements for floors over outside air are the same as those for ceilings.	

Wall Components

Wall	Opaque portions of above-grade walls Basement walls and kneewalls less than 50% below grade Peripheral edges of floors Gables walls bounding conditioned space Dormer walls Roof or attic kneewalls Through-wall chimneys Walls of an interior stairway to an unconditioned basement Skylight shafts
Glazing	Windows (including basement windows) Sliding glass doors Glass block Transparent portions of doors
Door	Opaque portions of all doors (including basement doors)

Floor and Foundation Components

Floor Over Unconditioned Space	Floors over an unconditioned crawl space, basement, garage, or similar unconditioned space
Basement Wall	Opaque portions of basement walls 50% or more below grade and basement kneewalls (if part of a basement wall 50% or more below grade)
Slab Floor	Perimeter edges of slab-on-grade floors
Crawl Space Wall	Walls of unventilated crawl spaces below uninsulated floors

Appendix D

Forms

The following forms are included in this Appendix:

- *Energy Label* - Describes the energy efficiency features installed in the residence. This label is optional. It may be posted at the building site or provided to the home buyer.
- *Take-Off Worksheet* - Provides a form for building take-offs.

Energy Label

Street Address _____

This home includes the following energy features:

Insulation R-Values

Insulating

Sheathing

R-Value

_____	_____	Ceiling
_____	_____	Ceiling
_____	_____	Wall
_____	_____	Wall
_____	_____	Floor
_____	_____	Basement Wall
_____	_____	Crawl Space Wall
_____	_____	Slab
_____	_____	Duct

Glazing/Door U-Values

U-Value

_____	Windows
_____	Windows
_____	Sliding Glass Doors
_____	Doors
_____	Doors

Mechanical System

Type and Fuel

Efficiency

Heating System	_____	_____
Cooling System	_____	_____ SEER
Water Heater	_____	_____ EF

Other Energy Features

Builder _____ Date _____

Take-Off Worksheet

Builder Name _____ Date _____

Builder Address _____

Building Address _____

Submitted By _____ Phone Number _____

Ceilings, Skylights, and Floors Over Outside Air

Description	Area	Insulation R-Value	Skylight U-Value
Ceiling	ft ²		—
Floor Over Outside Air	ft ²		—
Skylight	ft ²	—	

Walls, Windows, and Doors

Description	Area	Insulation R-Value	Glazing/Door U-Value
Wall	ft²		—
Window	ft²	—	
Door	ft²	—	
Sliding Glass Door	ft²	—	

Floors and Foundations

Description	Area or Perimeter	Insulation R-Value	Insulation Depth
Floor Over Unconditioned Space	ft ²		—
Basement Wall	ft ²		
Unheated Slab	ft		
Heated Slab	ft		
Crawl Space Wall	ft ²		

Equipment Efficiency (This section may be left blank if no credit will be taken for high-efficiency equipment.)

Heating _____ **AFUE/HSPF** _____

Cooling _____ **SEER** _____
 Efficiency _____ Make & Model Number _____

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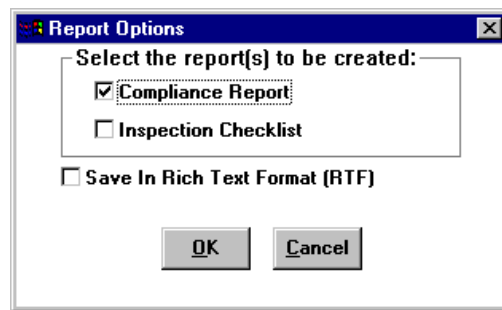
October, 1998

Printing and Saving Reports

MECcheck Version 2.07 Release 3 has been upgraded over Release 2 to provide additional report generation and printing capabilities. This addendum describes these new features, which are not addressed in the Version 2.07 *Software User's Guide*.

Saving Reports

After selecting the **Save Report** option from the **File** menu, the *Report Options* screen will appear. You may choose to save a Compliance Report, an Inspection Checklist, or both to the same file. You may also choose to generate a DOS text file (as was generated in Release 2), or a report in rich text format (RTF). A report generated in rich text format can be loaded into and printed from many word processors (such as Word or Word Perfect), allowing additional formatting flexibility and improved appearance. To generate the file in rich text format, select the box to the left of *Save In Rich Text Format (RTF)*. To generate a DOS text file, make sure this box is not selected.



Printing Reports

After selecting the **Print Report** option from the **File** menu, a modified version of the *Report Options* screen will appear. You may choose to print a Compliance Report, an Inspection Checklist, or both. Select the **Font** button to change the font and font size used to print the MECcheck report. Only non-proportional fonts available on your printer will be displayed in the *Font* dialog box. Select the **Print Setup** button to select a printer other than the Windows default printer or to specify other print options, such as the number of copies or the paper size. If the default options are adequate for your needs, you are not required to use either of these buttons -- just select the **OK** button to print the report. Font and printer options will be remembered and used on all subsequent reports until you exit the program.

